CTSW-RT-02-061

SAMPLING AND ANALYSIS PLAN

CALTRANS TAHOE BASIN WATER QUALITY CHARACTERIZATION AND SEDIMENT TRAP EFFECTIVENESS STUDIES MONITORING SEASON 2002-2003

Contract 43A0036 Task Orders 2 and 14

Prepared for:

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
SACRAMENTO, CALIFORNIA

OCTOBER 2002

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1.0 Project Overview

The goals of the Tahoe Basin Stormwater Monitoring Program (Study) are to:

1. Characterize stormwater runoff quality from Caltrans highway facilities located within the Tahoe Basin, including the major factors controlling the quality.

2. Characterize precipitation water quality to evaluate the relative contributions of precipitation to observed constituent concentrations in Tahoe area highway stormwater runoff.

3. Evaluate the treatment effectiveness of double-barrel sediment traps installed along Caltrans highways in the Tahoe area.

The first year of the Study focused on basic data gathering and on the development and testing of methods for high elevation monitoring.

The second year of the Study focused on more extensive data gathering. Three sites were added to better characterize differences in high elevation versus low elevation runoff, urban and rural runoff and commingled and non-commingled runoff. The objectives of the third year of this Study are:

Runoff Water Quality

1. Collect data to continue the characterization of runoff from urban and rural highways, based on the following assumptions:

   - There are two distinct types of roadway and right-of-way conditions in the basin: urban and rural

   - Rural roadway segments have lower annual average daily traffic (AADT) volumes than urban segments

2. Collect data to continue the characterization of highway runoff during snow management operations at both lake-level and mountain pass elevations, based on the assumption:

   - Snow management operates under two modes: high elevation and lake-level elevations

3. Collect data to continue the characterization of seasonal differences in highway runoff, based on the assumption:

   - There are three seasons: early season rain events (prior to highway deicing activities), snow melt events, and transitional rain, rain/snow mix events

4. Collect data to continue characterization storm water runoff quality from areas with commingled flow (Caltrans and non-Caltrans runoff), based upon the assumption:

- Surrounding landuse contributes to variations in runoff quality

5. Collect data to continue characterization storm water runoff quality across the Tahoe Basin, based upon the assumption:

   - Stormwater runoff quality varies depending upon the location within the Tahoe Basin

Precipitation Water Quality

1. Collect data to continue the characterization of precipitation quality, including:

   - Evaluate the variability of rainwater quality in the Tahoe Basin

   - Provide data to evaluate the relative contributions of precipitation to observed constituent concentrations in Tahoe area highway runoff

Sediment Trap Effectiveness Study

1. Collect data to assess the effectiveness of the double-barrel sediment traps, consisting of:

   - Amount of sediment retained within the sediment traps and overflow from the traps

   - Distribution of sediment size fractions retained and overflow

   - Quality of the sediment retained and overflow

   - Quality of storm water influent vs storm water effluent

2.0 Scope of This Plan

This Sampling and Analysis Plan (SAP) describes the monitoring of Caltrans highway stormwater runoff quality, precipitation quality, and sediment quality within the Tahoe Basin.

2.1 Runoff Water Quality

Monitoring of highway runoff will be conducted at six monitoring stations during early season rain events, rain, rain/snow mix events and snowmelt events.

2.2 Precipitation Water Quality

Precipitation samples will be collected at three highway runoff monitoring stations. Samples of "wet deposition" (rainfall and/or snowfall) only will be collected. Precautions will be taken to minimize collection of any dry deposition or "dryfall."

2.3 Sediment Amounts, Size Distribution, and Quality

Sediment samples will be collected at two runoff-monitoring stations in the Tahoe Basin through April 2003.

2.4 Double Barrel Sediment Trap Effectiveness

The treatment effectiveness of sediment traps will be evaluated at two sites in the Tahoe Basin through April 2003. The effectiveness will be evaluated based on the comparison of water quality data collected from both the inflow and outflow points. In addition, the effectiveness will be evaluated based on the amounts and types of sediments collected in each barrel and sediments that overflow from the traps and retained in the effluent filter box.

The portion of the sediment found in runoff representing particle sizes less than 20 µm will be characterized in more detail. Samples of untreated and treated runoff will be analyzed to determine the concentration mass of particles that range from 0.08 to 100 µm.

2.5 Suspended Sediment Concentration (SSC)

A comparative study will be performed to evaluate differences between the results from TSS and SSC analyses. In addition, differences between the results of three ASTM variations of SSC analyses will be assessed. Grab samples will be collected of untreated runoff, split by the laboratory and analyzed for TSS and SSC. Up to three grab samples will be collected from each site.

3.0 Project Organization and Responsibilities

This project will be conducted under the direction of Caltrans Headquarters. Camp Dresser & McKee inc.(CDM) will manage the project from its Sacramento Office.

Monitoring station preparation and equipment installation and equipment maintenance will be conducted by CDM. Tahoe-based field teams will conduct sample collection and other field data acquisition work. CalScience Environmental Laboratories of Garden Grove will conduct sample equipment cleaning and analyses of water samples. CDM's soils laboratory in Denver, Colorado will perform sediment analyses.

4.0 Monitoring Locations

Based on the study objectives, five categories were selected to represent runoff from roadways in the Tahoe Basin. These categories include:

- Annual Average Daily Traffic (AADT)
- Elevation
- Geographical distribution
- Source of the storm water runoff
- Presence of double-barrel sediment traps

Monitoring locations have been selected that represent each of the five roadway categories. Each site is under the jurisdiction of Caltrans District 3,the Lahontan

Regional Water Quality Control Board (LRWQCB), and the Tahoe Regional Planning Agency (TRPA). Locations of the six selected monitoring sites are presented in Figure 4-1 and are described below.

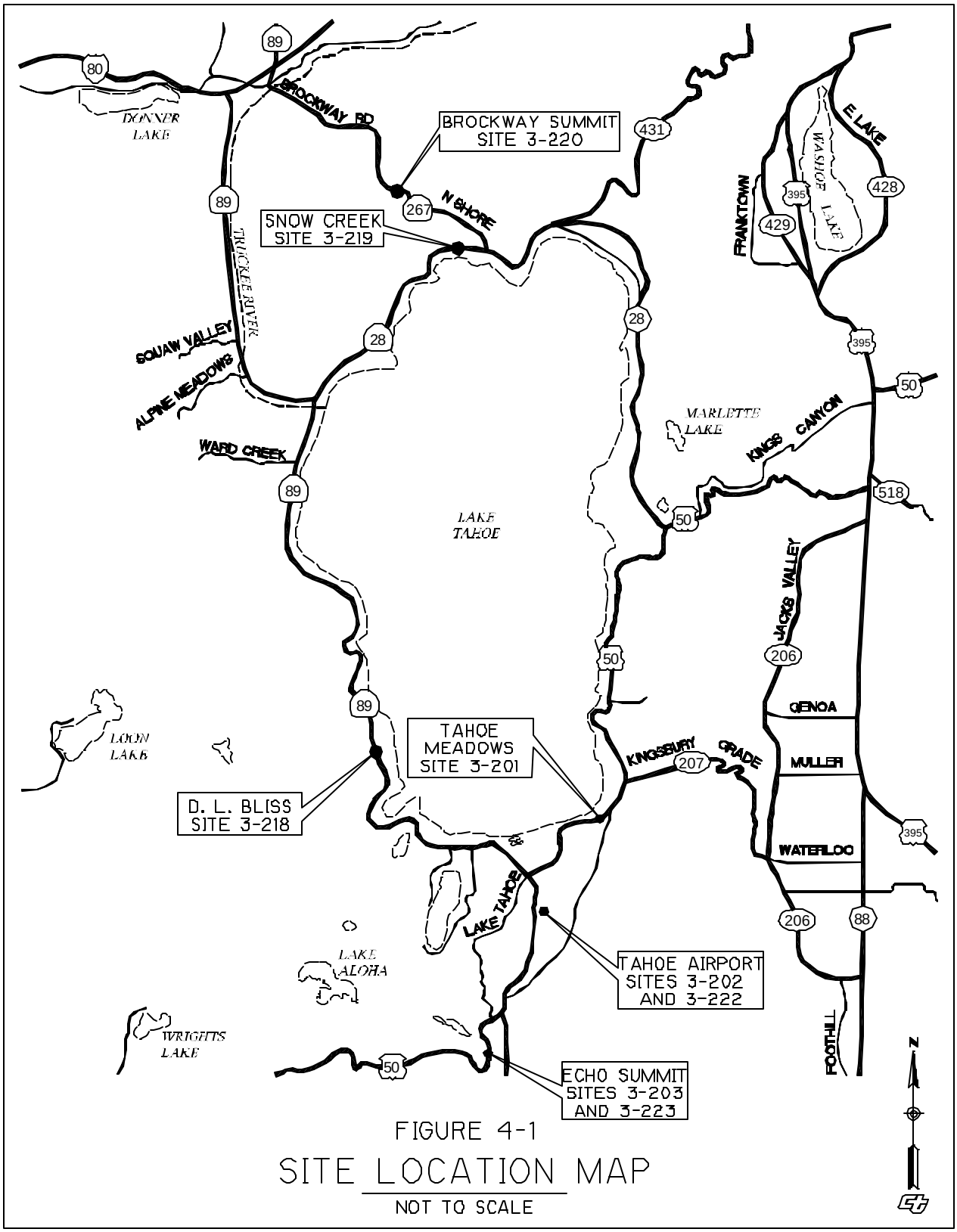


FIGURE 4-1

SITE LOCATION MAP

NOT TO SCALE

4.1 Highway 50 Near Echo Summit

This station (ID # 3-203 (influent) and 3-223 (effluent), 50E Echo Summit – El Dorado County – District 3) is located between the town of Meyers and Echo Summit, within the right-of-way of the eastbound lane of State Highway 50 at post mile 67.91. The site represents a rural, high elevation area with low AADT; it collects Caltrans-only flow and is located at a double-barrel sediment trap. This site is equipped to collect runoff influent and effluent samples, precipitation samples and sediment samples.

Highway 50 is a two-lane road at this point with a series of paved pullouts along the eastbound lane. Portions of both lanes drain to the curb along the eastbound lane where the station is located. Runoff from the highway flows along an asphalt curb and gutter into a double-barrel sediment trap.

View south of the upstream drainage of the Echo Summit site.

The drainage area is approximately 2,833 m^2 (0.7 acre). AADT is estimated to be 11,600. The site elevation is approximately 2,134 meters (7,001 feet).

Parking in the large turnout directly adjacent to the monitoring station may be used to access this station. During site visits when runoff is occurring, vehicles should be parked outside of the runoff flow stream.

Directions: From the City of South Lake Tahoe:

1. Get onto Highway 50, heading west.
2. Stay on HY 50 toward Echo Summit.
3. At post mile 67.9, turn into the large turnout located on left side of the road.
4. Meyers Grade Road and the Echo Summit pass are beyond the station further to the west.

4.2 Highway 50 Near Tahoe Airport

This station (ID # 3-202 (influent) and 3-222 (effluent), 50E Tahoe Airport – El Dorado County – District. 3) is located in South Lake Tahoe within the right-of-way of the eastbound lane of State Highway 50, just south of H Street (post mile 74.27), near the Tahoe Airport. This site represents a rural, lake-level elevation area with low AADT; it collects Caltrans-only flow and is located at a double-barrel sediment

View south of the drainage area and sampling equipment at the Tahoe Airport site. The double-barrel sediment traps are shown in the lower right foreground.

trap. This site is equipped to collect runoff influent and effluent samples, precipitation samples and sediment samples.

Highway 50 is a two-lane road at this point. Only the eastbound lane drains to the curb along the eastbound lane where the station is located. Runoff from the highway flows along an asphalt curb and gutter into a double-barrel sediment trap.

The drainage area is approximately 1,214 m^2 (0.3 acres). AADT is estimated to be 14,100. The site elevation is approximately 1,920 meters (6,299 feet).

This station may be accessed using the parking lot directly across the highway (on the west side) from the monitoring station. Parking on the paved portion of the highway's shoulder is not recommended at this location due to the curve of the highway and high traffic speeds. However, parking on the grassy portion of the shoulder is permitted as long as on-coming traffic is notified using signs and traffic cones as defined in Caltrans traffic control specifications.

Directions: From the City of South Lake Tahoe:

1. Get onto Highway 50, heading west.
2. Drive 1.2 miles from the intersection with Highway 89.
3. Just past H Street, turn into the parking area located on the right side of the road.
4. The station is located across the road.

4.3 Highway 50 Near Tahoe Meadows

This station (ID # 3-201, 50W Tahoe Meadows – El Dorado County – District 3) is located in South Lake Tahoe within the right-of-way of the westbound lane of State Highway 50, at the entrance to Tahoe Meadows residential development (post mile 79.79). This site represents an urban, lake-level elevation area with high AADT; it collects Caltrans-only flow and is located within an underground storm drain system. This site is equipped to collect only runoff samples.

Highway 50 is a four-lane road at this point. Only the two westbound lanes drain to the curb along the westbound lane where the station is located. Runoff from the highway flows along a curb and gutter and into a drain inlet. Runoff samples are collected in an 18-inch drainpipe that collects the stormwater runoff along this portion of the highway and conveys it to the Ski Run wetland treatment facilities.

View east of the drainage area and drain inlet at the Tahoe Meadows site. The monitoring equipment is housed in the vault in the left foreground.

The drainage area is approximately 3,237 m^2 (0.8 acres). AADT is

estimated to be 37,000. The site elevation is approximately 1,905 meters (6,250 feet).

This station may be accessed using the entrance/exit driveways to Tahoe Meadows. Parking is allowed in the area between the two driveways. The station is in the area between the highway and the light pole. The monitoring equipment is housed in an underground vault.

Directions: From the City of South Lake Tahoe:

1. Get onto Highway 50, heading east.
2. Drive 4.2 miles from the intersection with Highway 89.
3. Turn into the driveway for Tahoe Meadows at post mile 79.8.

4.4 Highway 89 Near D.L. Bliss State Park

This station (ID # 3-218, 89N - El Dorado County – District 3) is located along the border of D.L. Bliss State Park on the West Shore of Lake Tahoe within the right-of-way of the northbound lane of State Highway 89 at post mile 20.63. This site represents a rural, lake-level elevation area with low AADT; it collects Caltrans-only flow from the highway and a paved turnout, and is located at a double-barrel sediment trap. This site is equipped to only collect influent runoff samples.

Highway 89 is a two-lane road at this point. Portions of both lanes drain to the curb along the northbound lane where the station is located. Runoff from the highway flows along an asphalt curb and gutter, then through a paved swale between the pullout and the northbound lane, and finally into a double barrel sediment trap. Runoff samples are collected at the sediment trap inlet.

The drainage area is approximately 1,012 m^2 (0.25 acres). AADT is estimated to be 3,000. The site elevation is approximately 1,951 meters (6,400 feet)

Parking in the large turnout directly adjacent to the monitoring station may be used to access this station. During site visits when runoff is occurring, vehicles should be parked outside of the primary runoff flow stream.

Directions: From the City of South Lake Tahoe:

1. Get onto Highway 89, heading north.
2. Stay on HY 89 to D.L. Bliss State Park.
3. Within D.L. Bliss State Park on HY 89, turn into the large paved turnout located on right side (east side) of the road just south of post mile 20.63.

View north of a portion of the drainage area at the D. L. Bliss site. The drainage inlet is at the edge of the pavement in the center of the photograph.

4. The northern boundary of D.L. Bliss State Park is beyond the station to the North.

4.5 Highway 28 at Snow Creek

This station (ID # 3-219, 28W Snow Creek – Placer County – District 3) is located in Tahoe Vista, approximately one-quarter mile west of the intersection of Highway 28 and Highway 267 within the right-of-way of the westbound lane of State Highway 28, (post mile 9). This site represents an urban, lake-level elevation area with high AADT, commingled flow, and is located at a drain inlet with a sump bottom and an outfall pipe. This site is equipped to collect runoff influent samples and precipitation samples.

Highway 28 is a four-lane road at this point. In this area, drainage from the westbound lanes, Agatam Circle, and from commercial and private properties flows to the curb along the westbound lane where the station is located. Runoff from the highway flows along a curb and gutter and into drain inlet. Runoff samples are collected at the inlet to the drain inlet.

View west of the sampling equipment housing and drainage area at the Snow Creek site.

The drainage area is approximately 2,023 m^2 (0.5 acres). AADT is estimated to be 18,100. The site elevation is approximately 1,890 meters (6,200 feet).

This station may be accessed using the paved pullout located adjacent to the monitoring station. The station is located on the north side of Highway 28 just west the Snow Creek crossing.

Directions: From Kings Beach:

1. Get onto Highway 28, heading west toward Tahoe Vista.
2. Drive 0.25 miles from the intersection of Highway 28 and 267.
3. After crossing the Snow Creek Bridge, turn into the paved parking area immediately past the west side of the bridge.

4.6 Highway 267 Brockway Summit

This station (ID # 3-220, 267N Brockway Summit – Placer County – District. 3) is located near Kings Beach within the right-of-way of the northbound lane of State Highway 267, approximately two miles north of the intersection of State Highways 267 and 28 in Kings Beach (post mile 8.14). This site represents a rural, high elevation area with low AADT; it collects Caltrans-only flow from the highway and a paved turnout, and is located at a drain inlet with a sump bottom and outfall pipe. This site is equipped to collect only runoff influent samples.

In this area, Highway 267 is a two-lane road with bicycle lanes. Drainage from the crown of the highway and from an upslope paved turnout flows to the curb along the northbound lane into a drainage inlet. Runoff samples are collected at the entrance to the drainage inlet.

The drainage area is approximately 1,012 m^2 (0.25 acres). Annual average daily traffic (AADT) is estimated to be 8,500. The site elevation is approximately 1,951 meters (6,400 feet).

This station may be accessed using the paved turnout located immediately to the north of the monitoring station. Parking on the paved portion of the highway's shoulder is not recommended at this location due to the high traffic speeds.

View north of the drainage area at the Brockway Summit site. The drain inlet and outfall are shown in the right foreground.

Directions: From Kings Beach:

1. Get onto Highway 267, heading north.
2. Drive 2 miles from the intersection of Highways 267 and 28.
3. The station is located approximately 30 meters (98 feet) north of post mile marker 8.14.
4. Turn into the unpaved road, locate just north of the site and park along the shoulder.

A summary of selected monitoring site characteristics is presented in Table 4-1.

Table 4-1
Summary of Monitoring Site Characteristics and Monitoring Equipment

Site Characteristics	Monitoring Site and Station Numbers					
	Tahoe Meadows 3-201	**Tahoe Airport 3-202 & 3-222**	**Echo Summit 3-203 & 3-223**	**D.L. Bliss 3-218**	**Snow Creek 3-219**	**Brockway Summit 3-220**
Caltrans District	3	3	3	3	3	3
Regional Board	Lahontan, Region 6a	Lahontan, Region 6a	Lahontan, Region 6a	Lahontan, Region 6a	Lahontan, Region 6a	Lahontan, Region 6a
Highway	50	50	50	89	28	267
Post Mile	79.79	74.27	67.91	20.63	9	8.14
Longitude	119.56972	119.99939	120.03106	120.10878	120.04005	120.04705
Latitude	38.57139	38.89756	38.82858	38.98864	39.2393	39.25742
Elevation (Meters)	1,900	1,920	2,130	1,950	1,890	1,950
Catchment Area (m^2)	3,237	1,214	2,833	1,012	2,023	1,012
Drainage Type	Urban Highway	Rural Highway	Rural Highway	Rural Highway	Comingled Flow from Urban Highway, Commercial & Residential	Rural Highway
AADT	37,000	14,100	11,600	3,000	18,100	8,500
BMP Type	Wetland	Double-Barrel Sand Trap	Double-Barrel Sand Trap	Double-Barrel Sand Trap	Drain Inlet with Sump	Drain Inlet with Sump
Receiving Water Type	Seasonal Wetlands	Intermittent	Intermittent	Intermittent	Seasonal Wetlands	Intermittent
Rain Gage	No	Yes	Yes	Yes	Yes	Yes
Precipitation Sampler	No	Yes	Yes	No	Yes	No
Flow Equipment	Area-Velocity Probe	Bubbler Tube and Weir	Bubbler Tube and Weir	Bubbler Tube and Weir	Area-Velocity Probe	Area-Velocity Probe

5.0 Analytical Constituents

This section identifies the constituents to be analyzed in storm water runoff, precipitation, and sediment.

5.1 Runoff Water Quality

Runoff samples will be analyzed for constituents presented in Table 5-1. Sample type (sample collection method), EPA analytical method, sample bottle type, target reporting limit, volume required for analysis, sample preservation, and maximum holding time are also presented in Table 5-1.

Table 5-1
Highway Runoff Monitoring - Constituents to be Analyzed, Sample Type, EPA Method, Bottle, Volume, Preservation, and Hold Time Requirements

Constituent	Sample Type	EPA Method	Bottle	Target Reporting Limit	Vol. (ml)	Preservation	Holding Time
Conventional							
Conductivity	Flow-based comp.	120.1	HDPE	1 mg/L	50	4°C	28 days
Hardness as $CaCO_3$		130.2		2 mg/L	100	4°C	6 mo.
Temperature		NA		0.1 units	NA	None	ASAP
pH		150.1		0.1	50	None	15 min.
TDS		160.1		1 mg/L	100	4°C	7 days
TSS		160.2		1 mg/L	100	4°C	7 days
Turbidity		180.1		0.05 NTU	50	4°C	48 hrs.
Color		110.2		5 color units	100	4°C	48 hrs.
COD		410.1		10 mg/L	100	4°C; HCl or H_2SO_4; pH<2*	28 days
TOC/DOC		415.1		1 mg/L	100	4°C; HCl or H_2SO_4; pH<2*	28 days
Nutrients							
NO_3-N	Flow-based comp.	300.0	HDPE	0.1 mg/L	100	4°C	48 hrs.
NO_2-N		300.0		0.1mg/L	100		48 hrs.
NH_3-N		350.3		0.1mg/L	100		28 days
TKN		351.3		0.1 mg/L	100		28 days
Total Nitrogen (calculated)		--		0.1	--		--
Total Phosphorous		365.3		0.03 mg/L	100		28 days
Dissolved Phosphorous		365.3		0.03 mg/L	100		28 days
Dissolved Ortho-Phosphate		365.2		0.03 mg/L	100		48 hrs.
Metals (total & dissolved)							
Arsenic (As)	Flow-based comp.	206.3	HDPE	0.5 µg/L	100	4°C; HNO3; pH <2*	Filter for diss. & preserve 48 hrs. Analysis 6 mo.
Cadmium (Cd)		200.8		0.2 µg/L			
Chromium (Cr)		200.8		1 µg/L			
Copper (Cu)		200.8		1 µg/L			
Iron (Fe)		200.9		25 µg/L			
Lead (Pb)		200.8		1 µg/L			
Nickel (Pb)		200.8		2 µg/L			
Zinc (Zn)		200.8		5 µg/L			
Other							
SSC	Grab	ASTM D 3977-97A, B & C	HDPE	1 mg/L	500	4°C	7 days
Chlorides	Flow-based comp. or Grab	300.0	HDPE	0.02 mg/L	100	4°C	28 days
Oil & grease	Grab	1664	wide-mouth glass	1 mg/L	1000	4°C; HCl or H2SO4; pH<2	28 days

*No preservative at time of composite sample collection; preservation at laboratory during sample splitting.

5.2 Precipitation Water Quality

Precipitation samples will be analyzed for constituents listed in Table 5-2. The constituents are a subset of Table 5-1 and are considered likely to be present in precipitation in measurable quantities. The list is confined to those constituents for

which samples may be present , and for which collection of sufficient sample volume can be expected to permit analysis.

Limitations in sample volume are common in precipitation monitoring, and the goal will be to analyze as many of the listed constituents as is feasible for each monitoring event, given the specific precipitation amount and the actual sample volume collected. Metals and nitrate are considered the highest priority for precipitation analysis. It is assumed that most constituents will be present in the dissolved form in precipitation; it is therefore not necessary to analyze for total recoverable metals.

Table 5-2
Highway Precipitation Monitoring - Constituents to be Analyzed, Sample Type, EPA Method, Bottle, Volume, Preservation, and Hold Time Requirements

Constituent	Sample Type	EPA Method	Bottle	Target Reporting Limit	Vol. (mL)	Preservation	Holding Time
HIGH-LEVEL PRIORITY CONSTITUENTS							
Conductivity		120.1		1 mg/L	50	4°C	28 days
pH		150.1		0.1	50	none	15 min
NO_3-N	Composite	300.0	HDPE	0.1 mg/L	100	4°C	48 hrs.
NO_2-N		300.0		0.1mg/L	100		48 hrs.
Metals (dissolved only)							
Arsenic (As)	Composite	206.3	HDPE	0.5 µg/L	100	4°C; HNO3; pH <2*	Filter for diss. & preserve 48 hrs. Analysis 6 mo.
Cadmium (Cd)		200.8		0.2 µg/L			
Chromium (Cr)		200.8		1 µg/L			
Copper (Cu)		200.8		1 µg/L			
Iron (Fe)		200.9		25 µg/L			
Lead (Pb)		200.8		1 µg/L			
Nickel (Pb)		200.8		2 µg/L			
Zinc (Zn)		200.8		5 µg/L			
MID-LEVEL PRIORITY CONSTITUENTS							
Hardness as $CaCO_3$	Composite.	130.2	HDPE	2 mg/l	100	4° C	6 mo.
Chloride		300.0		0.02 mg/l			28 days
ADDITIONAL CONSTITUENTS (when sample volume is adequate)							
Total Phosphorous	Composite	365.3	HDPE	0.03 mg/l	100	4° C	28 days
Dissolved Orthophosphate		365.2		0.03 mg/l			48 hrs.
TKN		351.3		0.1 mg/l			28 days
Total Nitrogen * (calculated)	--	--	--	0.1 mg/L	--	--	--

*No preservation at time of composite sample collection; preservation at laboratory during sample splitting

The precipitation analytical list is subject to review and revision pending evaluation of the initial monitoring results and other issues and priorities as determined by Caltrans.

5.3 Sediment Size Distribution and Quality

A list of analytical constituents to be analyzed in sediment samples is presented in Table 5-3. Table 5-3 also summarizes constituents, EPA analytical methods, target reporting limits, volumes required for analysis, sample preservation, and maximum hold times.

The sediments will be wet-sieved in the laboratory using the sieve sizes presented in Table 5-4. The sieve sizes may be modified in order to collect sufficient sediment masses of the various size fractions for chemical analyses. This may be accomplished by compositing various size fractions following sieving. Sediment sizes smaller than 20 µm will be analyzed for grain size distribution using the electrozone particle counting method.

Table 5-3
Sediment Sample Laboratory Analyses

Constituent	EPA Analytical Method	Reporting Limit (mg/kg)	Required Mass/ Volume	Sample Preservation	Maximum Hold Time
Total Phosphorus	EPA Method 365.3	1	2 g	Chilled	28 days
Total Organic Carbon	EPA Method 415.1	50	2 g	Chilled	28 days
Total Nitrogen	EPA Method 351.4	1	2 g	Chilled	48 hours
Arsenic	EPA Method 6010	0.5	1 g	Chilled	6 months
Cadmium		0.5			
Chromium		0.5			
Copper		0.5			
Lead		5			
Nickel		2.5			
Zinc		0.5			
Iron		0.5			
Grain Size Distribution Analysis – Sieve and Hydrometer Methods	ASTM D4464	NA	50-100 g	NA	NA

Table 5-4
Sieve Sizes for the Grain Size Distribution Analysis

U.S. Standard Sieve Size	Mesh Opening (microns)
4	4,750
6	3,350
8	2,360
10	2,000
16	1,180
20	850
30	600
40	425
50	300
70	212
100	150
200	75
400	38
635	20

6.0 Data Quality Objectives

To provide scientifically defensible data in fulfillment of program objectives discussed in Section 1, data quality objectives are used to establish acceptable measures of data quality. The data quality objectives for this project include specifications for sampling and analytical procedures, and performance criteria for laboratory analytical work.

Analytical methods, target reporting limits, sample preservation requirements, and maximum allowable holding times are presented in Tables 5-1 and 5-2. Performance control limit criteria for precision and accuracy are presented in Tables 6-1 and Table 6-2. Tables 6-1 and 6-2 list the control limits for water samples and sediment samples, respectively. For guidance on application of performance acceptance criteria and QA / QC data evaluation refer to Section 13 of Guidance Manual: Stormwater Monitoring Protocols, Caltrans, May 2000 (CTSW-RT-00-005).

Table 6-1
Control Limits for Precision and Accuracy for Water Samples

Constituent	EPA Method	Maximum Allowable RPD	Recovery Lower Limit	Recovery Upper Limit
Conventional				
Conductivity	120.1	20%	NA	NA
Hardness as $CaCO_3$	130.2	20%	80%	120%
pH	150.1	20%	NA	NA
TDS	160.1	20%	80%	120%
TSS	160.2	20%	80%	120%
Turbidity	180.1	20%	NA	NA
COD	410.1	20%	80%	120%
Color	110.2	20%	NA	NA
TOC/DOC	415.1	15%	85%	115%
Chlorides	300.0	20%	80%	120%
Oil & grease	1664	18%	79%	114%
Nutrients				
NO_3-N	300.0	20%	80%	120%
NO_2-N	300.0	20%	80%	120%
NH_3-N	350.3	20%	80%	120%
TKN	351.3	20%	80%	120%
Total Phosphorus	365.3	20%	80%	120%
Dissolved Phosphorous	365.3	20%	80%	120%
Dissolved Ortho-phosphate	365.2	20%	80%	120%
Metals (total & dissolved)				
Arsenic (As)	206.3	20%	75%	125%
Cadmium (Cd)	200.8	20%	75%	125%
Chromium (Cr)	200.8	20%	75%	125%
Copper (Cu)	200.8	20%	75%	125%
Iron (Fe)	200.9	20%	75%	125%
Lead (Pb)	200.8	20%	75%	125%
Nickel (Pb)	200.8	20%	75%	125%
Zinc (Zn)	200.8	20%	75%	125%

Notes: RPD = relative percent difference between duplicate analyses.
Recovery, lower and upper limits refer to analysis of spiked samples.

Table 6-2
Control Limits for Precision and Accuracy for Sediment Samples

Constituent	EPA Method	Maximum Allowable RPD	Recovery Lower Limit	Recovery Upper Limit
Total Phosphorus	365.3	20%	80%	120%
Total Organic Carbon	415.1	15%	85%	115%
Total Nitrogen	351.4	20%	80%	120%
Arsenic (As)	6010	20%	75%	125%
Cadmium (Cd)	6010	20%	75%	125%
Chromium (Cr)	6010	20%	75%	125%
Copper (Cu)	6010	20%	75%	125%
Lead (Pb)	6010	20%	75%	125%
Nickel (Pb)	6010	20%	75%	125%
Zinc (Zn)	6010	20%	75%	125%
Iron	6010	20%	75%	125%

Notes: RPD = relative percent difference between duplicate analyses. Recovery, lower and upper limits refer to analysis of spiked samples.

7.0 Equipment

Each of the six runoff monitoring stations are equipped with American Sigma 900 peristaltic pump samplers, an American Sigma 950 flow meter and sensor, and a 12 Volt power source. Five of the six stations (excluding Tahoe Meadows) are also equipped with an American Sigma electronic tipping bucket rain gage and three of the six sites are equipped with precipitation sampling equipment. This monitoring equipment is housed in either a locked steel box enclosure or underground vault.

In addition to the equipment listed above, two of the six sites (Echo Summit and Tahoe Airport) are equipped with sediment sampling equipment. This equipment consists of a double barrel sediment trap and a #635 mesh size bag filter installed inside of an effluent discharge box. This filter bag is designed to capture sediments that pass out of the sediment traps. The monitoring station components are described below.

7.1 Automatic Sampler

The American Sigma 900 automatic sampler consists of Teflon coated stainless steel intake strainer, Teflon lined intake tubing, flexible pump tubing, a peristaltic pump, a composite sample bottle, and a controller. The sampler will be programmed to collect flow-paced composite samples. The intake strainer is securely fastened at a location in the runoff flow stream. The Teflon intake tubing is securely fastened to the intake strainer then housed in protective conduit to the point where the tubing enters the monitoring equipment enclosure. The Teflon intake tubing is attached to the flexible pump tubing at the sampler. The flexible pump tubing runs through the sampler peristaltic pump into the composite sample bottle.

The samplers will be configured to collect flow-weighted samples. After a programmed volume of flow has passed the flow monitoring point a signal will be sent from the flow meter to the sampler, and a sample aliquot collected. This programmed volume between sample aliquot collection is established based on forecasted rainfall totals and

estimated runoff volumes. Full container shut-off switches are installed to allow for continuous sampling until the sample bottle is full.

7.2 Flow Meter

American Sigma 950 flow meters will be utilized at each of the monitoring stations. The flow meter will be programmed to initiate water quality sampling based on user-selected conditions; generally the exceedance of some predetermined flow volume at the monitoring location. At stations with double-barrel sediment traps, a weir has been installed at the outlet of the second sediment trap. Using a bubbler technology to measure depth of flow over the weir, flow can be measured through the double-barrel sediment traps. The flow meter converts depth measurements to flow volumes based on the configuration of the weirs. At stations with outfall pipes, an area-velocity flow meter has been installed in the drainpipe. The flow meter calculates flow volumes from depth and velocity measurements through the drainpipe.

7.3 Rain Gage

American Sigma electronic tipping bucket rain gages will be used to measure and record precipitation amounts at each of the monitoring stations. The rain gage is mounted at the top of a vertical steel pole. Rainfall data is sent through a cable running inside the pole and into the data logger of the flow meter. The gage records precipitation in 0.254 millimeter (0.01 inch) increments. Rainfall is funneled into a tipping bucket mechanism that tips when a volume equivalent to 0.254 millimeters (0.01 inch) of precipitation has accumulated. Each bucket tip is counted and a signal is sent to the data logger to record the precipitation. The gage is not heated so it does not function at temperatures near or below freezing.

7.4 Precipitation Quality Sampler

Precipitation samples will be collect at the Echo Summit, Tahoe Airport, and Snow Creek sites. The samples will be collected in a high-density polyethylene (HDPE) liner that slips into a 13.25-liter (3.5 gallon) capacity plastic bucket. The bucket with liner will be pole-mounted in an area having a clear opening to the atmosphere, without vertical obstruction. The pole will extend approximately 2.4 meters (7.8 feet) above grade. The mounting pole will be attached to the runoff monitoring enclosure in the same manner as the rain gage pole.

7.5 Sediment Sampling Equipment

Sediment is passively retained in the double-barrel sediment traps and on filter fabric located in the effluent filter box. This passive sediment collection method is designed to collect the majority of the sediment load as the stormwater passes through the sediment traps and into the natural channel downstream. Sediment retained in the barrels and in the effluent filter box will be periodically collected using core samples and by removing the filter in the effluent filter box. Sample collection equipment is more thoroughly presented in Section 12.

8.0 Health and Safety

Health and safety procedures that have been established for the Caltrans Tahoe Basin Stormwater Monitoring Project must be followed at all times. These procedures are presented in the document, *Caltrans Tahoe Basin Stormwater Monitoring Program Health and Safety Plan*. A copy of the plan is located in Appendix A. Each field team member will receive a copy to review prior to the start of the monitoring project. A copy must always accompany each crew out in the field.

Several general procedures that must be followed at all times include:

- All field personnel must wear hard hats, traffic vests, and steel-toed boots when working outside the vehicle.
- Traffic control must be set up before conducting any work in the Caltrans right-of-way where personnel will be exposed to traffic. Standard traffic control measures include parking vehicles to shield personnel from traffic and using hazard lights.
- No field personnel will enter a sediment trap, manhole or storm pipe without submitting a confined-space entry permit with CDM. Confined space entry procedures are included in the Health and Safety Plan.
- Equipment housing lids can be very heavy. Personnel must be careful when lifting to avoid injury and/or spilling the samples (i.e., keep back straight and lift with your legs).
- Clean nitrile gloves will be worn by all field crewmembers when working with sampler bottles (empty and filled) and during grab sampling.
- All electronic equipment should be kept as dry as possible.
- Cell phones use should be avoided or minimized while driving.

9.0 Monitoring Preparations and Logistics

Sample bottle ordering, bottle labels, runoff monitoring tubing installation, field equipment maintenance, monitoring event selection criteria, weather tracking, notification procedures, and bottle labeling procedures are presented in this section.

9.1 Bottle and Blank Water Order

Prior to the first targeted storm and immediately after each monitored storm event, bottles for the next event must be ordered from the laboratory. Adequate composite and grab sample bottles will be ordered for each of the monitoring stations, plus bottles for quality control samples. Blank water will be ordered when blank samples are to be collected.

Prior to each targeted storm at least ten of the 10-liter (2.6 gallon) polyethylene composite sample bottles and lids shall be cleaned by the laboratory according to the methods specified in Appendix B.

9.2 Sample Labels

Grab and composite sample bottles should be pre-labeled to the extent possible before each stormwater-monitoring event. Pre-labeling sample bottles simplifies field activities, leaving only date, time, sample number, and sampling personnel names to be filled out in the field. Basic bottle labels are available pre-printed with space to pre-label by hand writing or typing. Custom bottle labels may be produced using blank labels, labeling software, and waterproof ink. The bottle label should include the following information, with other items as appropriate:

Caltrans Water Quality Monitoring Program
Tahoe Basin

Date: _____
Time: _____
Station #: _____(see below for sample code development)
Collected by: _____
Sample ID: _____
Sample Type: ❑ Composite ❑ Other: ____

Each sample bottle label shall include a sample identification code as shown below.

SSSS R YYMMDDHHmm TT##

Where:

SSSS	=	station number (3201, 3202…)
R, P, S1, S2, S3, Q	=	R = runoff, P = precipitation, S1 = sediment can 1, S2 = sediment can 2, S3 = Effluent Filter Box, Q = QA / QC Sample
YY	=	last two digits of the year (01)
MM	=	month (01-12)
DD	=	day (01-31)
HH	=	hour of the last sample collected (00-23)
mm	=	minute of the last sample collected (00-59)
TT	=	Type or QA / QC Identifier (if applicable) G = Grab, C = Composite
		EB = equipment blank
		FS = field split
		## = bottle number

Note: Day, hour, and minute represent the day and time when the last sample was collected.

Sample labels will include type of sample (precipitation samples are considered composite samples), type of QC sample (i.e. field splits), sampler's name, date, time, and location. For a composite runoff sample collected at Site 3202 collected on December 8, 2000, the sample number will be as follows given the last sample was collected ended at 4:15 PM: 3202 R 0012081615 C01

Sample labels will be placed on the bottle rather than the cap to identify the sample for laboratory analysis. Bottles should be labeled in a dry environment prior to field crew mobilization. Attempting to apply labels to sample bottles after filling may cause problems, as labels usually do not adhere to wet bottles. Following labeling, clear scotch tape should be applied over the label to prevent ink from smearing.

9.3 Intake and Suction Tubing Installation

Clean intake and pump tubing should be installed using "clean techniques," so as not to contaminate the teflon coated tubing. The tubing should remain double bagged until the time of installation. The tubing ends should be covered with clean latex material to keep the tubing clean during installation, which involves feeding the tubing through protective conduit. During installation, the intake and pump tubing should only be handled wearing clean nitrile gloves. During installation, the tubing ends should not touch any item not known to be clean. It is important to avoid kinking of the intake tubing during installation, as this will hinder sample collection.

Once the tubing has been installed, the laboratory-cleaned Teflon-coated stainless steel intake strainer should be installed using "clean techniques." During installation, the strainer should only be handled while wearing clean nitrile gloves. The strainer should be attached to the end of the intake tubing and secured at the designated sampling location. All hardware in the immediate area of the intake strainer (hardware used to secure the suction tubing and intake strainer) must be stainless steel, polyethylene, or Teflon to minimize the possibility of sample contamination.

9.4 Field Equipment Maintenance

Prior to the first targeted storm and immediately after each of the subsequent sampling events, field personnel will inventory field equipment (see Figure 9-1 for field equipment checklist). Field equipment should be kept in one location, which is used as a staging area to simplify field crew mobilization.

Field personnel shall also perform field maintenance and testing of equipment to ensure proper operation. At a minimum, the frequency and nature of equipment maintenance shall be consistent with the manufacturer's recommendations. Records will be kept of all equipment maintenance.

Figure 9-1. Field Equipment Checklist

Storm Kit Equipment List

- ☐ First aid kit
- ☐ Keys to enclosure locks
- ☐ Flashlights (2) - hand held and lantern
- ☐ Maps
- ☐ Precipitation sample buckets and liners
- ☐ Extra batteries
- ☐ Writing pens (2),
- ☐ Diagonal cutters
- ☐ Electrical tape
- ☐ Cable ties (assorted sizes)
- ☐ Utility knife
- ☐ Ziplock baggies (assorted sizes)
- ☐ Gloves - nitrile
- ☐ Duct tape

Storm Mobilization Equipment List

- ☐ Storm kit
- ☐ Log books / log sheets
- ☐ Paper towels
- ☐ Autosampler bottles
- ☐ Bottle labels
- ☐ Coolers and ice
- ☐ Laboratory-provided blank water
- ☐ Cellular phone
- ☐ Personal rain gear
- ☐ Hardhats and orange safety
- ☐ Traffic cones / signs
- ☐ Health and Safety Plan

Standard equipment preparation procedures will be conducted prior to each target storm that is monitored for water quality, precipitation quality and sediment. For the water quality monitoring equipment, the autosampler, flow meter and rain gage are all inspected. Tubing, clamps or cable ties, electrical connections, battery strength, intake strainer, flow probe and programming are all checked. For the precipitation monitoring, mounting poles and holders are inspected and cleared of any debris.

9.5 Sample Bottle Installation

Prior to each monitoring event, laboratory-cleaned sample bottles will be installed into both the autosampler and precipitation station using “clean techniques”. The sample bottles must be sealed in a plastic bag until the time of installation. The lids must be kept individually bagged when not in use. During installation, the bottles and lids should be handled only

while wearing clean nitrile gloves, and the lids should not touch any item not known to be clean. At no time should any object or material (even clean, gloved hands) contact the inner surface of a composite bottle or lid.

9.6 Sediment Filter Installation

Three times during the monitoring season , cleaned filters will be installed into the effluent filter box using "clean techniques". The filters will be sealed in a plastic bag until the time of installation. During installation, the filter fabric should be handled only while wearing clean nitrile gloves.

9.7 Storm/Event Selection Criteria

Event selection criteria for Runoff and Precipitation monitoring are presented below.

9.7.1 Runoff Monitoring

Selection criteria for summer thunderstorm runoff monitoring, fall/spring storm runoff monitoring, and snowmelt runoff monitoring is presented below.

Rain Storms

Rain storms that meet the following criteria will be considered for monitoring:

- Approximately 40% or higher probability of precipitation,
- At least a 24-72 hour dry period preceding precipitation.

Rain and Snow Storms

Rain and Snow storms (which may contain a mixture of rain and snow) that meet the following criteria will be considered for monitoring:

- Approximately 50% or higher probability of precipitation,
- A Quantity of Precipitation Forecast (QPF) of 0.5 cm or greater, and
- At least a 24-hour dry period preceding precipitation.

Snowmelt

Snow melt runoff monitoring differs fundamentally from stormwater runoff monitoring in that sampling can be initiated in response to runoff flow in the absence of precipitation. Once substantial snowfall has occurred, the following criteria will be considered for monitoring:

- Adequate snow is present on the ground to generate snowmelt runoff,
- Temperatures are forecasted to exceed 5^0C or 40^0F, and/or
- Salts are applied to melt the snow.

9.7.2 Precipitation Monitoring

Storms that meet the following criteria, which are the same criteria used for storm event selection for runoff monitoring, will be considered for precipitation monitoring:

- Approximately 50% or higher probability of precipitation,
- QPF of 0.5 cm or greater, and
- At least a 24-hour dry period preceding precipitation.

9.8 Weather Tracking

As a candidate storm approaches, a quantity of precipitation forecast (QPF) is projected by the contract weather forecasting service, the National Weather Service and the task manager. This is the amount of precipitation (in centimeters) expected over the entire storm event, and is normally provided along with the expected start time and duration of the storm. This information serves two essential purposes. First, it is necessary to determine, prior to making the decision to mobilize for a storm event, whether the storm will produce adequate runoff to permit collection of a meaningful set of samples. Second, because composite samples are typically collected on a flow-paced basis, samples must be collected at appropriate intervals, so as to not under-fill the composite bottles, based on the rainfall/runoff amounts expected during the course of the storm. Bottles can not be over filled because of the "full bottle shutoff" cage. When automated sampling equipment is used, the equipment must be programmed in advance with the appropriate flow-pacing rate.

If a storm event QPF is grossly over-predicted, and the actual rainfall amount falls far short of the prediction, there may not be enough sample collected during the course of the monitoring event to conduct the specified analyses. If the QPF under-predicts the amount of rainfall actually received, then the composite bottles may need to be replaced one or more times during the event. Because additional site visits are required when a storm is under predicted, an estimate of approximately 110% of the expected rainfall amount is often used in programming the samplers.

9.9 Notification Procedures

The telephone tree (Figure 9-2) shows the lines of communication and notification responsibilities for the monitoring project. The telephone tree is used for stormwater monitoring preparation activities, communications during monitoring, and coordinating demobilization activities following a monitored event.

The telephone tree shows pertinent telephone numbers for each person involved in the project, including laboratory personnel numbers for the purpose of after-hours sample delivery. Emergency telephone numbers are also listed, including the number for the hospital nearest the monitoring stations.

Figure 9-2. Telephone Tree

Caltrans Personnel
Masoud Kayhanian (UCD)
(916) 278-8112 o
Kuen Tsay (HQ) (916) 653-5240 o

Task Manager
Charlie O'Neill CDM
(916) 567-9900 o
(916) 202-8571 c
Lou Regenmorter CDM
(916) 567-9900 o
(916) 708-3755 c
(916) 567-9905 f

CalScience Laboratory
(714) 895-5495 o
(714) 894-7501 f

Steve Nowak (310) 827-6683 h
(714) 335-4034 c
Bob Sterns (949) 643-5517 h

Courier Service:
FEDX (800) 463-3339

Field Coordinator
Stefan Schuster CDM
(775) 588-0201 o
(916) 708-3574 c

Field Crew
Neal Batchelder
(530) 525-0179 h
(916) 708-3758 c
Christine Eklund
(530) 550-1255 h
(916) 708-1029 c
Alison Harlick
(775) 849-3993 h
(775) 853-0333 w
(775) 690-9343 c

Monitoring Equipment:
American Sigma
24 hour help line (800) 653-1230
Oratech (local sales rep.)
Rob Larsen (415) 467-9455 o
(415) 467-4319 f

Forecasters:
Weather Watch (619) 223-8163

National Weather Service (916) 979-3051

KEY
o = office
c = cellular
f = fax
h = home
p = pager
v = voice mail

Emergency: **911**
Hospital
Barton Memorial Hospital (530) 541-3420
Tahoe Forest Hospital (530) 587-6011

10.0 Runoff Water Quality Sample Collection

Clean sampling techniques, field crew mobilization, pre-event set-up activities, event monitoring activities, post-event activities, and special considerations for cold weather and snowmelt monitoring are presented below.

10.1 Clean Sampling Techniques

"Clean sampling" techniques are required to provide for the collection of water samples in a way that neither contaminates, loses, or changes the chemical form of the analytes of interest. Samples are collected using rigorous protocols, based on EPA Method 1669, as summarized below:

- Samples are collected only into rigorously pre-cleaned sample bottles.
- At least two persons, wearing clean nitrile gloves at all times, are required on a sampling crew.
- One person ("dirty hands") touches and opens only the outer bag of all double bagged items (such as sample bottles, tubing, strainers and lids), avoiding touching the inside of the bag.
- The other person ("clean hands") reaches into the outer bag, opens the inner bag, and removes the clean item.
- When a clean item must be re-bagged (such as a composite bottle lid), it is done in the opposite order from which it was removed.
- Clean nitrile gloves are changed whenever something not known to be clean has been touched.

In order to reduce potential contamination, sample collection personnel will adhere to the following rules while collecting stormwater samples:

(1) No smoking.

(2) Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles).

(3) Avoid allowing rainwater to drip from rain gear into sample bottles.

(4) Do not eat or drink during sample collection.

(5) Do not breath, sneeze, or cough in the direction of an open sample bottle.

For this program, clean techniques must be employed whenever handling the composite bottles, bottle lids, suction tubing, or intake strainers.

10.2 Field Crew Mobilization

When a candidate storm is approaching, or when a potential snowmelt event may occur, the monitoring task manager will alert the field crew and analytical laboratory. Field crews will be given notice to mobilize when precipitation or snowmelt has begun.

When first alerted, field crewmembers should check monitoring equipment and supplies to ensure they are ready to conduct monitoring. Once given the go-ahead by the monitoring task manager, the field crew members will obtain adequate ice for each station, including grab samples, and travel to each station to conduct final preparations for monitoring.

Site Check

- Set-up traffic safety controls. Upon arriving at each station, traffic safety controls must be set-up as required.

- Access equipment. Access to the monitoring equipment is gained by unlocking the padlocks to the lid of the enclosure, and lifting the lid until both hinges lock. Be careful to check for spiders and wasps in the padlock case and inside the housing.

- Perform all the inspections listed in both the Sampler Inspection and Set-Up sections of the *Station Visit Checklist for Set-Up/Bottle Replacement/Shut-Down Form* (Appendix C).

10.3 Pre-Event Set-Up

The following are set-up activities that should be conducted prior to each runoff monitoring event. Flow charts designed to facilitate equipment checks and programming are presented in Appendix D.

10.3.1 Check Autosampler Set-up and Programming

1. Confirm charge on battery is at least 12 volts. If charge is less than 12.0 volts, replace the existing battery with a freshly charged battery.

2. Inspect tubing and connections.

    - Remove sampler control lid by releasing the upper row of latches (3).

    - Perform the following checks:

        1) Intake tubing for kinks and twists (remove or straighten if found).

        2) Clamps for tightness and conditions (tighten if loose, replace if broken or missing).

        3) All electrical connections for tightness.

        4) Pump tubing for cracks and excessive wear / tear (replace if found).

3. Place clean sampler bottle in the base of the sampler.

   - Release the bottom row of latches (3) and lift off the control section using the handles on the side of the sampler.
   - Pump tubing must be connected and not kinked.
   - Place a clean composite bottle with lid in the base.
   - Fill the base with crushed ice (approximately one 5-pound bag).
   - Using clean techniques, remove the bottle lid and store in a clean Ziplock bag (this lid will be reused when retrieving full composite bottle), and replace with clean tubing-hole lid.
   - Place the control section back onto the base, making sure the cage for the full bottle trigger fits into the mouth of the sample bottle. Shut each latch.

4. Review sampler programming.

   - Open the site notebook (or Appendix C) to the page documenting the Sampler Programming.
   - Compare the entries displayed by the sampler to those entries highlighted in the set-up document.

     1) Turn on the sampler by pressing the ON key. After a moment, the display reads either "READY TO START", "PROGRAM HALTED", or "PROGRAM COMPLETE." Press the * key, located next to the display window.

     2) Press the NO key to the question, "Alter Parameters?"

     3) The sampler now automatically scrolls through selected parameters.

     4) Upon completion of the review, the display should again read "READY TO START", "PROGRAM HALTED", or "PROGRAM COMPLETE."

   - Notify the Field Coordinator of any differences between the sampler's program and set-up document; re-program as instructed by the Field Coordinator.
   - Press the START PROGRAM key. The display should read "PROGRAM RUNNING," if not the sampler must be re-programmed based on the entries in the set-up document.

5. Match the sampler's clock to the flow meter's clock.

   - Wake up the flow meter by pressing the button on upper right side of the case.
   - The current time and date are displayed on the top bar of any display screen.

- Press the TIME READ key on the sampler to display the current time and date; they will be displayed for several seconds.

- The sampler's time and date should match the flow meter's time to the minute.

- If there is a difference between the two times, change the sampler's time to match the flow meters unless the flow meter is obviously wrong.

- Change the sampler's time and/or date.

    1) Press the TIME SET key.

    2) The time and date will be displayed with the hour flashing, change the hour by pressing the appropriate numerical key(s) and then pressing the YES/ENTER key.

    3) Minutes will now be flashing and can be changed by entering the correct numeric values and pressing the YES/ENTER key.

    4) Continuing this same procedure for setting time and date, pressing the YES/ENTER key to skip over correct entries.

    5) After the correct year is entered, the display will first read "SYNCHRONIZE TIME" and then "- ENTER- AT TIME".

    6) Press the YES/ENTER key to start the clock; the display will then move through "CLOCK IS NOW SET", the new time and date, and finally stop at the program status.

6. Replace the control lid. Place the lid back over the control section and close the three latches, being careful not to pinch the sampler tubing.

10.3.2 Check Flow Meter Set-up and Programming (See Appendix D)

1. Wake the flow meter.

- Press the button on the upper right hand side of the flow meter to wake the meter and illuminate the screen.

- If the STATUS SCREEN is not shown (check the upper right corner), this screen will need to be accessed.

    1) Open the clear plastic case lid by unlatching the two latches on the right side.

    2) Press the MAIN MENU key

    3) Press the "STATUS" option

4) the STATUS SCREEN should now be displayed

2. Record flow and rainfall volumes. Read the total flow in liters (l) and the total rainfall (cm) from the screen and record these values on the Set-Up section of the *Station Visit Checklist for Set-Up/Bottle Replacement/Shut-Down Form* at the designated space.

3. Review flow meter programming, if directed by the Field Coordinator.

   - Open the site notebook to the page documenting the Flow Meter Set-up and Programming.
   - From the Main Menu screen, select the "SETUP" option.
   - From the Setup screen, select the "REVIEW ALL ITEMS" option.
   - The current programming will be displayed. To view all entries, use the option to scroll through the entire listing.
   - Compare the programmed items to the entries documented on the *Flow Meter Set-up and Programming Form* located in the station notebook. If they do not match, call the Field Coordinator for direction.
   - Press the Main Menu key to return to the main menu.

4. Program the trigger volume, if directed by the Field Coordinator.

   - Press the RUN / STOP key to halt the program. The word "HALTED" should be flashing in the lower left corner.
   - Press Main Menu key to access the Main Menu screen.
   - Select the "SETUP" option.
   - Select the "MODIFY SELECTED ITEMS" option.
   - Scroll down the listing until "SAMPLER PACING" is highlighted, press the "SELECT" option.
   - Accept "ENABLE" by pressing the "ACCEPT" option.
   - Clear the existing entry, by selecting the "CLEAR ENTRY" option.
   - Key in a new value per the Field Coordinator, and press the key for the "ACCEPT" option. Enter trigger volume on the setup form.
   - Return to the main menu screen by pressing the "RETURN" option.

- Press the RUN / STOP key, then select the "RESUME" option. The program will restart, which is confirmed by the word "RUNNING" displayed in the lower left corner.

5. Shut the case lid and close the latches.

10.4 Event Monitoring Activities

Stormwater runoff monitoring event activities are described below.

10.4.1 Composite Sample Collection

After all of the pre-event set-up steps have been taken, flow weighted composite samples will automatically be collected at the entrance of the drain inlet or sediment trap. Sample collection will continue as long as significant runoff flow is present.

At two sites (Echo Summit and Tahoe Meadows), composite samples will be collected at the influent and discharge points of the double-barrel sediment traps. These samples will be used to assess effectiveness of the double-barrel sediment traps in reducing constituents of concern from highway runoff. This assessment will be based upon the comparison of water quality data collected from both the inflow and outflow points. At these two sites a second autosampler will be used to collect the effluent samples. Figure 10-1 illustrates the general layout of the runoff sampling equipment at the Echo Summit and Tahoe Airport sites.

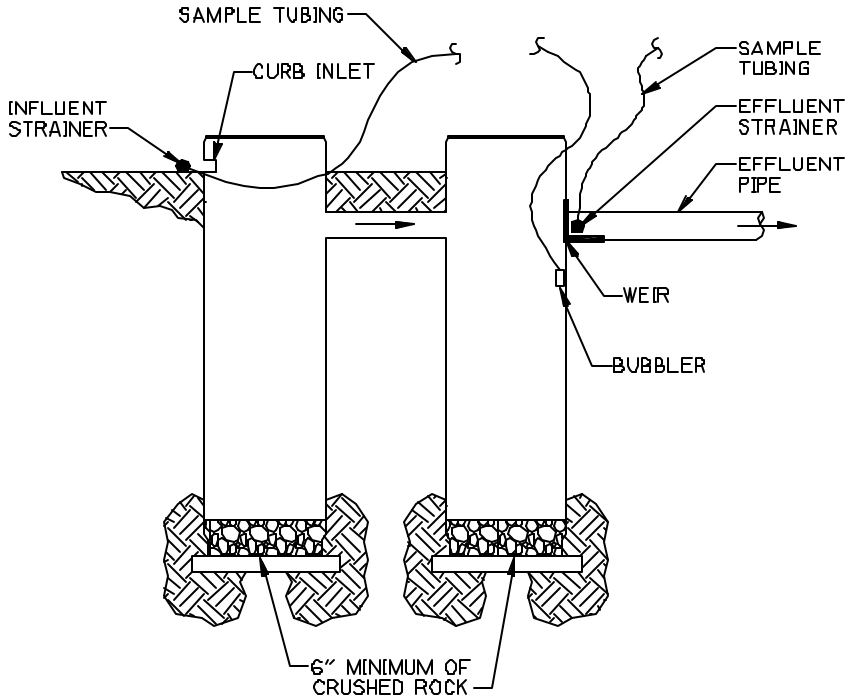


FIGURE 10-1 - Double-Barrel Sediment Trap Sampling Station

TYPICAL SECTION

NOT TO SCALE

10.4.2 Oil and Grease Grab Sample Collection

Grab samples for oil & grease will be collected at each influent monitoring site during at least three separate runoff events including: early rain events, rain-snow mix events and snowmelt events. It is desired that grab samples be collected during storm event peak flow. However, due to the difficulty in predicting the time of peak flow, grab sampling during peak flow may not be possible. Therefore, to the greatest extent possible, grab samples will be collected at the approximate mid-point of the discharge period.

Oil & grease grab samples will be collected by directly submerging the sample bottle into the flow stream. After collection, the bottle will be capped and placed on ice.

10.4.3 SSC Grab Sample Collection

Grab samples for SSC and TSS comparison will be collected from each influent monitoring site during three separate runoff events. A single grab sample will be collected in a 10L sample bottle and split at the laboratory for analysis of TSS using EPA Method 160.2 and for SSC using ASTM Methods D 3977-97A, B and C. To minimize sample heterogeneity, the sample will be agitated and split at the laboratory using a sample splitter. In order to apply a correction factor for use with ASTM Method D 3977-97A, TDS will be analyzed using EPA Method 160.1.

Sampling times will be noted to identify the place on the flow hydrograph where each sample is collected. The grab samples will be pumped into one container using the autosampler. After each round of grab sampling, the autosampler will be re-started to continue with its programmed sampling routine.

10.5 Post-Event Activities **(See Appendix D)**

1. If the STATUS SCREEN is not shown (check the upper right corner), this screen will need to be accessed.

2. Perform all tasks listed in the Shut-Down Checks section of the *Station Visit Checklist for Set-Up/Bottle Replacement/Shut-Down Form.*

3. Record the sampling times on the Field Data Log (Appendix C).

4. Fill in the top portion of the form, making sure to indicate the “composite sample replacement” number (especially important if bottles have been replaced over the course of the event at a particular site).

5. Turn the page over and fill in the station ID number, time, and date on the top three lines.

6. Record the individual sampling data in the table.

    - Press the TIME READ key on the sampler for three (3) seconds, the time of the first sample should be displayed

- Record date, time, and any notes on the "Trigger #1" line of the Sample Identification Form
- Press the ENTER key to move to the next sample time and record information on line #2 of the table
- Continue pressing the ENTER key and recording information on subsequent lines until "PROGRAM HALTED" is displayed

7. Record flow and rainfall volumes
   - Press the button on the upper right hand side of the flow meter to wake the meter and illuminate the screen.
   - If the STATUS SCREEN is not shown (check the upper right corner), this screen will need to be accessed.
   - Open the clear plastic case lid by unlatching the two latches on the right side.
   - Press the MAIN MENU key
   - Press the "STATUS" option
   - the STATUS SCREEN should now be displayed
   - Read the total flow in liters (l) and the total rainfall (cm) from the screen and record these values on the Shut-Down section of the *Station Visit Checklist for Set-Up/Bottle Replacement/Shut-Down Form* at the designated space.
8. Complete sample bottle labels
   - Complete the bottle label for each filled and partially filled bottle. This task can be performed for all labels at once using the information from the just-completed Sample Identification Form.
   - For writing ease, perform this task under cover to keep the labels and pages as dry as possible.
   - Complete the lower portion on the front page of the Field Data Log at the same time.
9. Remove bottle
   - Lift off the control section off the base using the handles on the side of the sampler.
   - Remove the lid from the Ziplock bag and place it securely on the bottle.
   - Remove the filled or partially filled bottle.

1) Dry off the bottle

2) Place the completed label on the bottle, not the lid

3) Place a strip of clear packing tape over the label

4) Place the bottle in a cooler

- Pack each cooler with ice to keep samples cool.

10. Estimate Sample Coverage

- Note the following information:

1) Total number of successful samples

2) Times rainfall and runoff started

3) Time of first sample was collected

4) Time when last sample was collected

5) Times when rainfall and runoff ended

6) Portion of hydrograph covered (first, middle, last)

7) Peak flow captured

8) Estimate of hydrograph covered by sampling (%)

11. Site Exit

- Complete the Shut-down section of the Station Visit Checklist in the *Set-Up/Bottle Replacement/Shut-Down Form*. Field crews must complete the form and document the findings on this form before leaving the station.

- Fill in the *Site Visit Log* (Appendix C). Site visit log is located in the front of the station notebook. Place the notebook back on the shelf.

- Keep the completed forms at the office.

- Secure site. Remove any waste from the site, carefully close the housing lid, and lock up the enclosure.

- Inspect the sampler strainer and flow probes. If accessible from the outside, inspect the sampler strainer and flow probes; note any problems (debris or damage to the probes, strainer, tubing, and cords).

10.6 Special Considerations for Cold Weather Monitoring

Cold weather sampling activities may be hampered by two potential difficulties that are not present in moderate and warm weather: snow accumulation and freezing of sample water in the sample line. Measures to accommodate these potential problems will include:

- Regular snow removal
- Regular ice removal from around the equipment
- Insulation of the sampler cover and sample tubing conduit
- Maintaining a positive gradient from sample intake to sampler pump
- Checking of air temperature prior to and during sample collection
- Additional checking of the equipment by field crews, and
- Manual grab sampling during times when autosamplers cannot be used

10.6.1 Snow Removal

Accumulation of snow may interfere with the ability of field crews to access the monitoring equipment and perform sample collection functions. In addition, highway snow removal activities may cause additional accumulations along the highway right-of-way where the monitoring stations are located.

A snow removal contractor may be retained to provide regular clearing of snow at each monitoring station, to ensure that field crews have space for vehicle parking and have access by foot to the equipment enclosures, and that the enclosures themselves are free and clear of snow. This function should be performed on a regular basis (after every snowfall), to reduce the build-up of snow throughout the season, and to ensure that field crews have access to the stations at all times for monitoring activities. Snow and ice should also be removed from areas where it will block flow to the monitoring site.

10.6.2 Ice Removal

Accumulation of ice may interfere with the ability of the equipment to monitor flows and collect samples. The ends of the bubbler line, weirs and autosampler strainers all need to be kept free of ice. This function should be performed on a regular basis (prior to each sampling event).

10.6.3 Equipment Insulation

To help prevent freezing of the water in the sample line, the sample tube conduits will be insulated with pipe insulation wherever they are exposed to the outside, and the sampler cover will be lined with insulation material to help retain heat generated by the sampler.

10.6.4 Sampler Tube Gradient/Purge

To help prevent the freezing of water in the sampling line, the sampling tube will continue to be set so as to maintain a positive gradient from intake to sampler pump. This will allow sample water to drain fully from the tube after each aliquot.

The field crews will also ensure that the Sigma 900 sampler will continue to be programmed to perform a final purge after each sample aliquot is collected.

In the event that sample water is retained in the pump tubing and freezes, this could bind up the sampler pump. This would likely cause the sampler's fuse to blow before any damage occurs to the pump. Field crews will therefore need to check pump operation and verify that the fuse has not blown and that the unit is still operational. Extra fuses will be maintained on hand to cover this possibility.

10.6.5 Manual Grab Sampling

Snowmelt runoff may occur under weather conditions when autosamplers cannot be used. For example, snowmelt runoff may occur during a winter storm event when temperatures are below freezing, but snow control operations create runoff by using sediment and salts to melt the snow falling on the roads. Through attempts to conduct automated monitoring it may be discovered that, despite the field crews' best efforts, the autosamplers are unreliable under cold-weather conditions, and the effort required to keep them operational may be better served to simply collect manual grab samples. If this situation occurs, several grab samples may be taken to characterize an extended snow melt period (e.g., every four hours for a maximum of 24 hours). Manual grab sampling will only be conducted as long as the sites are accessible and snow control operations will not endanger the field crews.

10.7 Snowmelt Runoff Monitoring

Snowmelt runoff monitoring differs fundamentally from stormwater runoff monitoring in that sampling can be initiated in response to runoff flow in the absence of precipitation. Once substantial snowfall has occurred, field crews will need to track weather conditions so as to be alert to the possibility of significant snow melt. When the desired conditions occur (warming temperatures after a period of snow accumulation), field crews will program the automated equipment to collect flow-proportioned composite samples of the melting snow. This will include the following modifications to the typical runoff monitoring protocols:

- Field verification of conditions
- Automated equipment programming
- Visual and photographic observations

These modifications are described below.

10.7.1 Field Verification of Conditions

Field crews will verify that snowmelt runoff is occurring, and that there are no obstructions to runoff flow. As described above for cold weather monitoring, field crews also will verify the air temperature. If the temperature is above 5°C, and there is no ice present in the sampling tube, autosamplers will be used. Otherwise the event will be aborted or manual grab sampling may be performed, with multiple grabs collected on a time-paced basis dependent on the duration of the expected runoff.

10.7.2 Automated Equipment Programming

Field crews will use their best judgment about the expected flow volume that will be observed during a given monitoring period. Initially, it is recommended that the flow pacing be programmed at the same level as for a low (1.3 cm) rainfall event. To ensure composite sample representativeness, the goal will be to collect at least eight aliquots for each monitoring event, with a minimum number of six aliquots, as specified in the Guidance Manual for a small storm event.

Because snow melt may continue at varying rates for days, it will be necessary to limit the composite collection period to provide some degree of standardization and permit compliance with sample holding time requirements. The snowmelt sampling composite period therefore will be limited to 24 hours from the start of composite sampling. Field crews will also make observations of runoff flow rates at various times and in various conditions during the winter/spring snow-melt season to provide better approximations of the runoff volume to be expected from periods of snow melt.

If runoff continues after the initial 24-hour period, the existing bottle will be collected and a new bottle inserted so the sampling can continue for another 24 hours.

10.7.3 Visual and Photographic Observations

Field crews will make visual and photographic observations before and after each snowmelt runoff-sampling event. These observations will include:

- Approximate depth of snow in snow banks and on the ground
- Weather conditions during week leading up to monitoring event
- Visual condition of snow pack in sampling area
- Photographs of snow pack and snow-melt runoff before, during and after monitoring
- Brief summary of snow management activities conducted by Caltrans

An additional snowmelt monitoring log sheet will be filled out for these events. Refer to the example of the snow melt log sheet in Appendix C.

11.0 Precipitation Sample Collection

Precipitation samples will be collected in a high-density polyethylene (HDPE) liner that slips into a 3.5-gallon capacity plastic bucket. The bucket with liner will be pole-mounted in an area having a clear opening to the atmosphere, without vertical obstruction. The pole will extend approximately 2.4 meters (7.8 feet) above grade.

11.1 Pre-Event Set-Up

The sampling liners must be pre-cleaned prior to each monitoring event, according to the composite bottle cleaning protocols used for the runoff composite samples, as specified in Appendix B. The liners will be sealed with plastic after cleaning until they are slipped into the buckets on-site on the mounting poles. The liners must be stored so as to minimize exposure to environmental contamination. Blank samples must be run on the sampling liners in the same manner and using the same schedule as runoff composite samples.

Sampling bucket liners will be delivered to the sampling locations, unsealed, slipped into the bucket on the mounting poles as late as is feasible before the onset of precipitation, so as to minimize collection of dry deposition Clean techniques must be used when slipping the clean liners into the buckets and at all other times when handling precipitation sampling containers. .

11.2 Event Monitoring

Rain water and snow samples will be collected directly into the pole-mounted sampling bucket. Snow samples will be allowed to melt in the bucket.

Precipitation samples are particularly susceptible to contamination, due to their relatively low concentrations of pollutants. Care must be taken during all phases of sampling to minimize exposure of the samples to sources of contamination. To reduce potential contamination, sample collection personnel must adhere to the clean sampling techniques presented in Section 10.1 as well as the following rules while collecting precipitation samples:

- Never unseal the precipitation-sampling liners near a running vehicle. When possible, park the field vehicles out of the immediate sample collection area.
- Always wear clean, powder-free nitrile gloves when handling precipitation sampling liners and sample bottles.
- Never touch the inside surface of the sample bucket liner, even with gloved hands.
- Never allow the inner surface of the sample bucket liner to be contaminated by any material other than the sample water.
- Never allow any object or material to fall into or contact the collected sample water.
- Do not allow rainwater to drip from rain gear or other surfaces into sample buckets.

11.3 Post Event Activities

At the conclusion of the monitoring event, the samples collected in the precipitation sample buckets must be removed from the mounting poles as soon as possible after precipitation has stopped. The samples will then be poured directly into clean HDPE one-liter bottles. The bottles will be capped and labeled following the sample designation shown in Section 9.2.

All samples will be held at 4°C (on ice or refrigerated) until analysis. Samples will be delivered to laboratories along with the runoff characterization samples, using the procedures described in Section 12.

12.0 Sediment Sample Collection

Several potential concerns have been identified with the runoff based sampling technique for measuring sediment during storm events:

- The sampling inlet is typically screened to prevent clogging of the automatic sampling equipment. This also effectively screens out the larger size fractions from the sediment that is collected. In addition, the larger size sediments may not be collected due to gravity separation within the sampling tube.

- Sampling protocols used to measure sediment require large volumes of stormwater. For example, a sieve analysis may require approximately 120 grams sediment. Assuming an average total suspended solids (TSS) concentration of 200 milligrams per liter (mg/L), approximately 600 liters (160 gallons) of water sample would be needed to collect enough sediment for this analysis. Table 12-1 summarizes other sample volumes required for different TSS concentrations.

- The sampling inlet is sometimes positioned above the invert of a flow channel to prevent clogging of the automatic sampler. As a result, larger size sediments moving near the bottom of the channel by rolling, sliding, or skipping may not be collected, thereby not incorporating the larger sediment particle sizes in the sediment sampling.

Table 12-1
Example Sample Volumes Required for Sieve Analysis

TSS Concentration (mg/L)	Water Sample Volume Required (liters)
20	6,056
200	606
2,000	60

This SAP details sediment sampling protocols for Caltrans to implement. Sediment analytical results obtained from following these protocols will be compared to the previous years' sediment analytical results to determine if the protocols can be improved. In addition, the previous sediment sampling results will be evaluated for

possible adjustment to allow combination with results under the new protocols for statistical analysis of sediment concentrations.

12.1 Background

This section presents a discussion of sediment terminology, sediment sampling methods, and sediment characterization.

12.1.1 Sediment Terminology

Figure 12-1 is a diagram of sediment size (diameter in microns [µm]) for various classifications of solids expected in stormwater runoff.

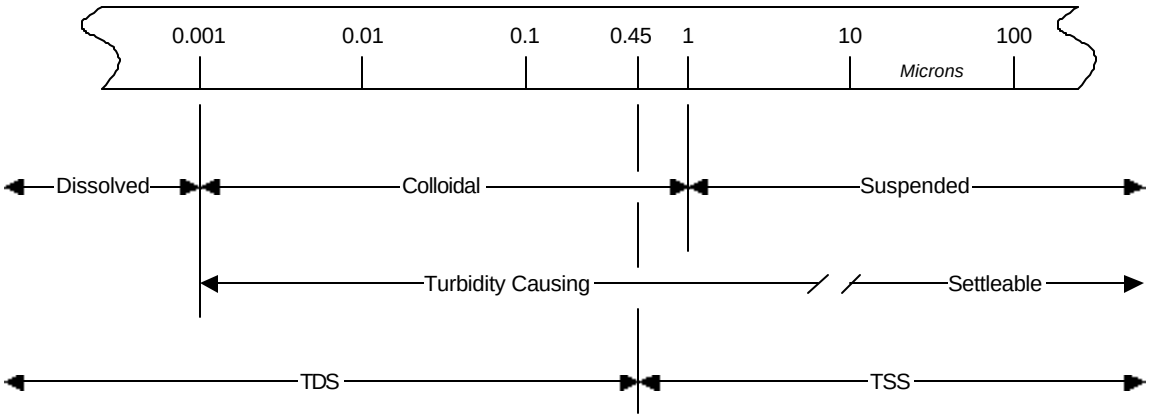


Figure 12-1. Sediment Classification

As shown, stormwater runoff will contain dissolved solids (<0.001 µm), colloidal solids (0.001 – 1 µm) and suspended solids (>1 µm). Colloidal solids (if present) and the smaller suspended solids (less than about 10 µm) typically are turbidity causing while the larger suspended solids (greater than about 10 µm) are typically settleable. Settleable solids will settle out due to gravity over time, with the smaller particles requiring longer periods of time to settle. Colloids are microparticles or macromolecules that remain suspended in waters because their gravitational settling is less than 0.01 cm / sec (Stumm et. al 1981). Differentiation between the various categories of solids generally will vary depending on such parameters as particle density, chemical composition (organic versus inorganic), flow rate, and turbulence. The cut-off between turbidity causing and settleable solids is especially sensitive to these parameters and will, therefore, vary depending on site conditions. Conversely, the cut-off between total dissolved solids (TDS) and total suspended solids (TSS), which are determined by standard analytical methods, is operationally defined at 0.45 µm. The 0.45 µm filtrate (measuring TDS) will contain turbidity causing colloids (if present) in addition to dissolved solids, while the particles retained on the 0.45 µm filter (measuring TSS) will consist primarily of particles in the suspended solids category (both turbidity causing and settleable) with some larger turbidity causing colloids.

12.1.2 Sediment Contaminants

The physical and chemical characteristics of the sediment affect its mobility and bioavailability to contaminants. For example, the oxidation/reduction status influences the retention or release of metals; the organic matter content affects the affinity of metals and nonpolar organic contaminants to the sediment; and the size and texture (sand, silt, or clay) of the particles affects which contaminants are more readily adsorbed to the sediment particles.

In addition, several particular constituents are found in highway runoff due to exposure to traffic. Typical constituents found in highway runoff and their sources are summarized in Table 12-2.

Table 12-2
Sources of Contaminants

Constituent	Primary Sources
Particulates	Pavement wear, vehicles, atmosphere, maintenance, snow/ice abrasives, sediment disturbance
Nitrogen, Phosphorous	Atmosphere, roadside fertilizer use, sediments
Lead	Tire wear, lubricating oil and grease, bearing wear, atmospheric fallout
Zinc	Tire wear, motor oil, grease
Iron	Auto body rust, steel highway structures, engine parts
Copper	Metal plating, bearing wear, engine parts, brake lining wear, fungicides and insecticides use
Cadmium	Tire wear, insecticide application
Chromium	Metal plating, engine parts, brake lining wear
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear, asphalt paving
Manganese	Engine parts
Bromide	Exhaust
Cyanide	Anticake compound used to keep deicing salt granular
Sodium, Calcium	Deicing salts, grease
Chloride	Deicing salts
Sulphate	Roadway beds, fuel, deicing salts
Petroleum	Spills, leaks, blow-by motor lubricants, antifreeze, hydraulic fluids, asphalt surface leachate
PCBs, Pesticides	Spraying of highway right of ways, atmospheric deposition, PCB catalyst in synthetic tires
Pathogenic Bacteria	Soil litter, bird droppings, trucks hauling livestock/stockyard waste
Rubber	Tire wear

Source: Kobringer, 1984.

12.2 Event Monitoring

Sediment sampling methodologies used during the first two years of the Lake Tahoe Stormwater Program required modification. Field observations during sediment sampling showed that the sampling techniques could be modified to better represent actual conditions of typical double barrel sand traps in the Tahoe Basin. These observations included:

- The filter bags lining the sediment trap cans were inhibiting the proper function of the traps by clogging and preventing infiltration causing higher flows and subsequently higher sediment loads to exit the traps.

- Large sediment accumulations cause the filter bags to tear or become displaced in the bottom of the can leading to sediment spillage and incomplete sample recovery.

- The three shelf filter box for the sand trap effluent would clog quickly and overflow causing most of the sediment to leave the filter box without being captured.

In order to correct these issues, a modified sediment sampling procedure utilizing a combination of core sampling and the filter approach will be employed. A detailed description of this method follows.

12.2.1 Sediment Sample Collection

Core samples will be used to collect the sediment contained within each sand trap, and a 20 µm filter cloth (located within the effluent filter box) will be used to capture sediment discharged from the second sediment trap. Full sediment core samples will be collected so that the sediment mass of each trap can be estimated. A diagram of the sediment trap and effluent filter box configuration is shown in Figure 12-2.

Sampling Equipment
The following sampling equipment is needed to conduct this sampling approach:

- Filter fabric (#635 [20 µm] mesh)

- Steel boxes for filter fabric material with one tray for #635 [20 µm] mesh

- Sediment core sampler, soil sample jars or other appropriate containers

- Distilled water

- Nitrate gloves

Pre-Event Preparation
Prior to sampling, the inlets will be thoroughly cleaned and the depth of the empty sand traps measured.

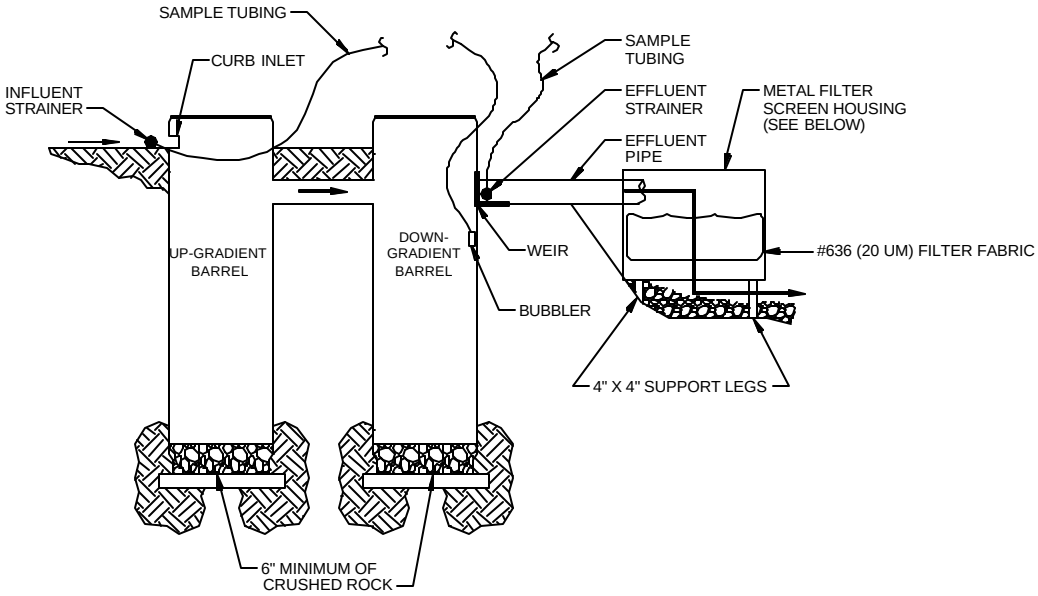


Figure 12-2. Sediment Trap Configuration

Core Sampling

Core samples will be collected from each sediment trap. A five point sample will be collected by driving the core sampler from the top of the sediment to the bottom of each sediment trap at five representative locations as determined in the field. Full core sample tubes will be collected so that a total sediment mass estimation for each sediment trap can be performed. After collection, the five sediment cores will be composited into a single container, labeled, and sent to the lab under chain of custody documentation.

Sediment samples will be collected using clean sampling techniques. To minimize the potential for cross-contamination, the core sampler will be cleaned after use in each sediment trap. Cleaning will consist of washing the core sampler with distilled water and thoroughly drying the core barrel with a clean cloth.

Effluent Filter Box

Sediment in the effluent filter box will be passively collected in a single 20 µm filter bag. Following the monitoring period, the filter bag will be removed from the effluent filter box, placed in an appropriate container and sent to the lab under chain of custody documentation. The filter bag will be installed and removed using clean sampling techniques.

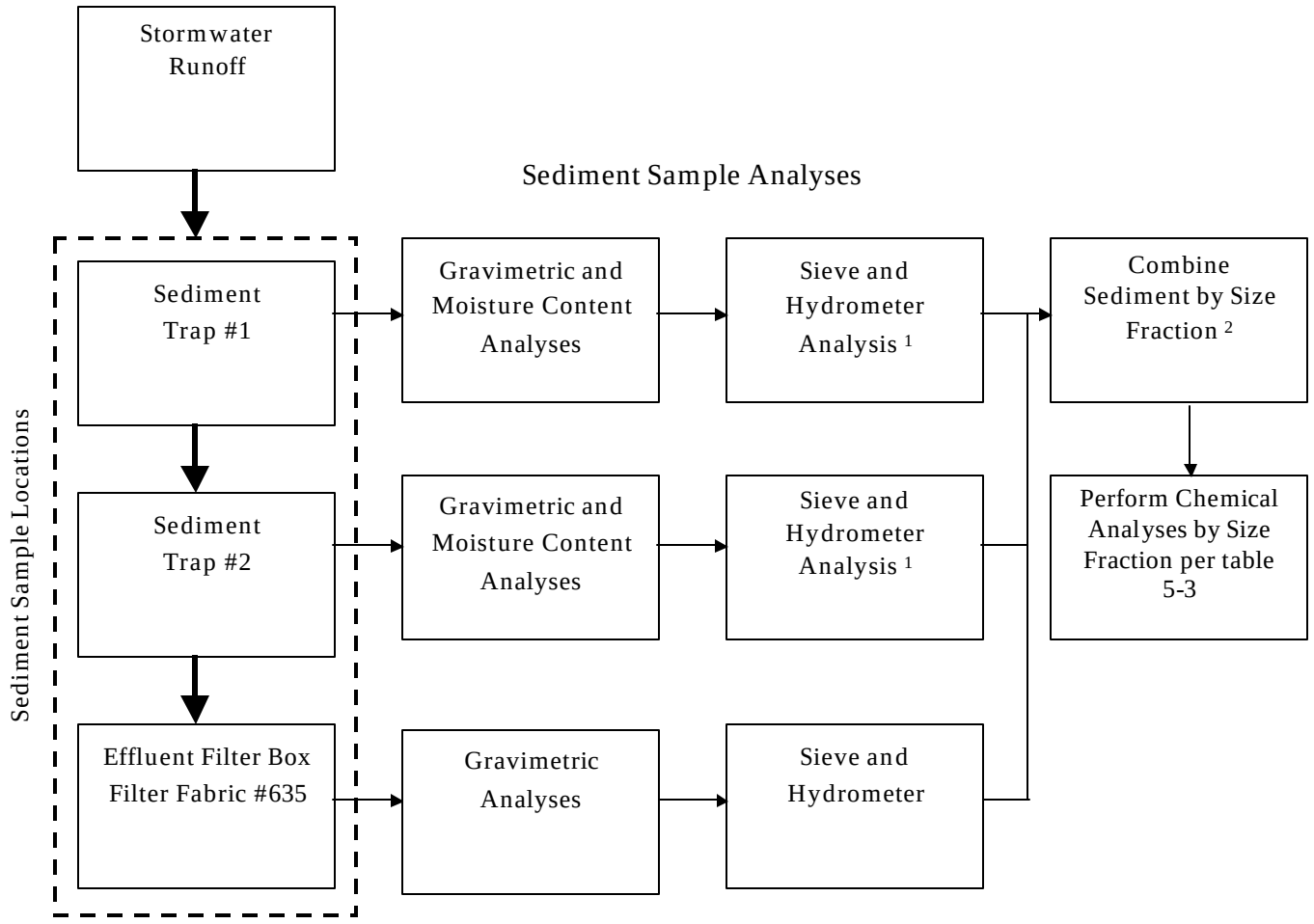
Sediment Sample Analysis

Sediment from the composited core samples from each sediment trap will be weighed and samples will be collected for moisture content analysis. After the sediment is dried, a grain size determination of sediment from each sediment trap will be performed via sieve and hydrometer analysis. Chemical analyses will be performed by size fraction for

constituents listed in Table 5-3. A diagram of the sediment sample analyses is presented in Figure 12-3.

Sediment retained in the cloth filter bag will be weighed with the filter at the laboratory, then flushed to further remove the sediment from the filter. Following collection of sediments, the filter fabric sheet will be dried and re-weighed in order to calculate the amount of sediment not removed by washing (e.g., entrained within the filter pores). This step is necessary to evaluate the amount of fine sediments that are not included in the grain size and chemical analyses.

Figure 12-3 Sediment Sample Analyses



Notes: [1] Sieve sizes modified to include those specified in Table 5-3.
[2] Size fractions will be combined to facilite chemical analyses.

Large Arrows indicate stormwater flow direction.
Small arrows indicate sample processing.

12.2.2 Small Particle Sample Collection

Small particles (20 µm or less) will be collected using subsamples of selected runoff composite samples from each site. Subsamples will be collected by drawing a discrete aliquot from a thoroughly mixed composite sample. The concentration of small particles will be assessed using the electrozone particle counting method.

The electrozone method (based on the Coulter principle) measures the electrical current between two electrodes in the liquid on either side of a small aperture, in which a suspension of particles is forced to flow. As the particles pass through the aperture, the impedance between the electrodes changes and produces an electrical pulse having a magnitude proportional to the particle volume. The pulses are electronically scaled, counted and accumulated in size related channels. These results produce a size distribution curve. Typical electrozone analyzers can analyze particles ranging from about 0.4 – 1,200 µm size (equivalent spherical volume diameter) by counting up to 2,000 particles per second.

13.0 Sample Delivery/Shipping

Following the collection of each sample, the sample bottle label must be completed, the sample kept on ice, the chain-of-custody form filled out, and the sample packaged for shipping to the laboratory.

13.1 Chain-of-Custody

Chain-of-custody (COC) forms will be filled out for samples submitted to the laboratory. Sample date, location, and analyses requested shall be noted on each COC. Additionally, the note “filter for dissolved metals immediately” shall be added to all composite sample COC forms. COC forms shall be placed in a Ziploc bag inside the sample cooler for shipment to the laboratory. Copies of COC forms shall be kept with field notes.

13.2 Sample Packaging/Shipping

Laboratory personnel will keep samples on ice from the time of collection to the time of receipt. It is imperative that samples be analyzed within holding times (refer to Table 5-1 and 5-2). Coolers should be securely taped shut and properly labeled.

Ship water samples to:
CalScience Environmental Laboratories — Attn: Steve Nowak (714) 895-5495
7440 Lincoln Way
Garden Grove, CA 92841

Ship sediment samples to:
Camp Dresser & McKee — Attn: Todd Burgesser (303) 383-2370
2714 Walnut Street
Denver, CO 80205

14.0 QA/QC Sample Collection

Composite or grab QA / QC samples will be collected throughout the year from different monitoring locations during monitoring events. The monitoring site from where the samples will be collected will be based upon the sample volume collected. QA / QC samples will be collected in accordance with the frequency described below in Table 14-1.

Table 14-1
Recommended QC Sample Frequency

QA/QC Sample Type	Minimum Sampling Frequency	Constituent Class
Field Duplicate	Once every ten samples collected at a given site or once per sampling station per monitoring year, whichever is more frequent.	All
Lab Duplicate	Once every ten samples collected at a given site or once per sampling station per monitoring year, whichever is more frequent.	All
Equipment Blank	Equipment blanks should be collected prior to each sampling season for each piece of equipment to be used for sample collection (bailers, pumps and carboys).	Dissolved metals, nutrients, conductivity, pH, TOC/DOC
Bottle Blanks	Composite and sample bottles should be blanked every batch [1]; or manufacturer or laboratory-certified to concentrations below the reporting limits used for the sampling program.	Dissolved metals, nutrients, conductivity, pH, TOC/DOC
Field Blanks	Once every ten samples collected at a given site or once per field crew per monitoring year, whichever is more frequent.	Dissolved metals, nutrients, conductivity, pH, TOC/DOC
Matrix Spike/Matrix Spike Duplicates	Once every ten samples collected at a given site or once per sampling station per monitoring year, whichever is more frequent.	Dissolved metals

Notes:
[1] A batch is defined as the group of bottles that have been cleaned at the same time, in the same manner; or if decontaminated bottles are sent directly from the manufacturer, the batch would be the lot designated by the manufacturer in their testing of the bottles.

Each type of QA / QC sample described below will be collected from the selected site. Based upon sample volumes , the site from where the QA / QC samples are collected will vary from monitoring event to monitoring event. Descriptions and specific collection methods for each type of quality control sample type are described below.

Equipment Blank (dissolved metals, nitrogen series, pH, and TOC / DOC)

Blank samples should be collected before using sampling equipment to verify that the equipment is not a source of sample contamination. Stormwater monitoring programs normally include equipment blanks to check sample tubing and strainers and sample bottles, especially composite bottles. An equipment blank is collected by passing blank water through the sampling equipment.

Equipment blanks should be submitted "blind" to the laboratory (labeled as normal samples).

Field Blank (dissolved metals, nitrogen series, pH, and TOC / DOC only)

Composite sample field blanks (e.g., for metals analysis) should be collected at the time that the final composite bottle is removed from the autosampler. Blank water provided by the laboratory will be poured directly into a clean composite container on site.

Field blanks should be submitted "blind" to the laboratory (labeled as normal samples, with a false site name).

Matrix Spike / Duplicate (dissolved metals only)

Matrix spike and matrix spike duplicate (MS / MSD) analyses should be requested on a specified sample for each storm for trace metals. No special sampling considerations are required. However, additional sample volume (up to 6 L) must be collected for each analysis.

Field Duplicate / Split (all analyses)

Grab sample field duplicates should be collected immediately following the collection of normal grab samples.

Composite sample field splits should be produced in a clean environment prior to shipment to the laboratory. Double the normal composite sample volume is required for these samples. The composite sample field split is generated by agitating the composite sample until it is well mixed and pouring half of the composite volume into a second clean composite bottle using clean techniques. The field duplicate should be submitted "blind" to the laboratory (labeled as normal samples, with a false site name).

Laboratory Duplicate (all analyses)

No special sampling considerations are required for composite sample laboratory duplicates. However, double the normal composite volume must be collected and laboratory duplicate analysis requested on the chain-of-custody form. Laboratory duplicates should be collected for the sites and storm events specified in the QA / QC schedule. Grab sample laboratory duplicates should be collected immediately following the collection of normal grab samples.

15.0 QA/QC Data Review

This section presents a discussion of the initial data quality screening and detailed QA / QC review.

15.1 Initial Data Quality Screening

When the laboratory reports are received following each monitored storm event, it is important to check the reported data as soon as possible to identify errors committed in

sampling, analysis or reporting. The laboratory must report results in a timely fashion (typically within 30 days of receipt of the samples) and the results must then be reviewed immediately upon receipt. This may allow for re-analysis of questionable (out-of-range) results within the prescribed holding time. The initial screening includes the following checks:

- ✓ Completeness. The chain of custody forms should be checked to ensure that all laboratory analyses specified in the sampling plan were requested. The laboratory reports should also be checked to ensure that all laboratory analyses are performed as specified on the chain of custody forms, including the requested QA / QC analyses.

- ✓ Holding Time. The lab reports should be checked to verify that all analyses were performed within the prescribed holding times.

- ✓ Detection Limits. The reported analytical detection limits should meet or be lower than the levels agreed upon prior to laboratory submission.

- ✓ Reporting Errors. On occasion laboratories commit typographical errors or send incomplete results. Reported concentrations that appear out of range or inconsistent are indicators of potential laboratory reporting problems, and should be investigated when detected. Examples of this would be a dissolved concentration greater than the corresponding total recoverable concentration, or a constituent concentration orders of magnitude different than concentrations reported for the same constituent for other events.

Irregularities found in the initial screening should immediately be reported to the laboratory for clarification or correction. This process can identify and correct errors that would otherwise cause problems further along in the data evaluation process, or in subsequent uses of the data for higher-level analysis. When appropriate, reanalysis of out-of-range values can increase confidence in the integrity of questionable data. The laboratory data will also be reviewed using the Caltrans Stormwater Management Program Laboratory EDD Error Checker and Automated Data Validation Program.

15.2 Detailed QA/QC Data Review

The data quality evaluation process is structured to provide checks to ensure that the reported data accurately represented the concentrations of constituents actually present in water quality samples. Data evaluation can often identify sources of contamination in the sampling and analytical processes, as well as detect deficiencies in the laboratory analyses or errors in data reporting. Data quality evaluation allows monitoring data to be used in the proper contest with the appropriate level of confidence.

QA / QC parameters that should be reviewed are classified into the following categories:

1. Contamination check results (method, field, trip, and equipment blanks)

2. Precision analysis results (laboratory, field, and matrix spike duplicates)

3. Accuracy analysis results (matrix spikes, surrogate spikes, laboratory control samples, and external reference standards)

Each of these QA / QC parameters should be compared to the data quality objectives listed in Section 6. The key steps that should be adhered to in the analysis of each of these QA / QC parameters are:

1. Compile a complete set of the QA / QC results for the parameter being analyzed.

2. Compare the laboratory QA / QC results to accepted criteria (DQOs).

3. Compile any out-of-range values and report them to the laboratory for verification.

4. Attach appropriate qualifiers to data that do not meet QA / QC acceptance criteria.

5. Prepare a report that tabulates the success rate for each QA / QC parameter analyzed.

Refer to Section 13 of the Caltrans Stormwater Monitoring Protocols Guidance Manual for specific direction on evaluating the results of contamination, accuracy, and precision checks, and on qualifying data that do not meet data quality objectives.

16.0 Data Management and Reporting

Analytical data for this project must follow the data validation procedures outlined in Section 13 of *Guidance Manual: Stormwater Monitoring Protocols, Caltrans, July 2000*. Additionally, electronic and hardcopy data must be filed in an organized and easily accessible fashion. Analytical data must be reported in the format consistent with the Caltrans Stormwater Management Program database. See *Caltrans Stormwater Management Program 2001-2002 Data-Reporting Protocols, October 2001* (or latest version, Section 14 of *Guidance Manual: Stormwater Monitoring Protocols, Caltrans, July 2000* for data reporting guidance, and *Caltrans Data Reporting Protocols Particle Analysis, September 2002* for particle data reporting guidance. The Caltrans Data Analysis Tool (Caltrans DAT) will be used to calculate summary statistics for laboratory datasets that include censored (not detected) data.

17.0 References

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Appendix A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

CALTRANS TAHOE BASIN WATER QUALITY CHARACTERIZATION AND SEDIMENT TRAP EFFECTIVENESS STUDIES

Prepared for:
STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
SACRAMENTO, CALIFORNIA

OCTOBER 2002

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Section 1
Introduction

This Health and Safety Plan (HSP) identifies the health and safety procedures for work to be conducted for the Caltrans Tahoe Water Quality Characterization and Sediment Trap Effectiveness Studies. This includes equipment installation activities, field monitoring activities and periodic maintenance of the monitoring stations and equipment as required at the six monitoring sites. Implementation of this plan is the responsibility of the CDM Project Managers. The Site Safety Officer assists the CDM Project Managers in carrying out this responsibility at the work site by enforcing the requirements of the Health and Safety Plan and by the authority to suspend work to protect worker health and safety. Either the Site Safety Officer or the Corporate Health and Safety Officer may suspend or limit work, or direct changes in work practices, if the HSP and/or work practices used are deemed inadequate.

This HSP may not be used for work other than that described in Section 4.0. This plan is to be followed by all CDM personnel and CDM's subcontractors who will be participating in the monitoring program. All personnel included in the monitoring program shall be responsible for reading this plan and following its procedures.

CDM and CDM's subcontractors will share responsibility for providing health and safety management. This includes joint planning, management, site control, reporting and problem solving. Each employer is also responsible for its employees in accordance with the employer's own health and safety policies.

Section 2
Project Health and Safety Personnel

Project and Safety Personnel

This section identifies key project health and safety personnel involved in the Caltrans Tahoe Basin Stormwater Monitoring Program. This outline presents the names, titles, and specific responsibilities of these individuals in terms of project health and safety.

Personnel

Title	**Name and Number**	
Corporate Health and Safety Officer	Chris Marlowe	(908) 225-7000 (800) 313-5593

Responsibilities

- Overall health and safety advisor.
- Interface with CDM personnel, subcontractors and Caltrans' project managers in matters of health and safety.
- Review, approve or disapprove project Health and Safety Plans.
- Monitor compliance with Health and Safety Plans.

Title	**Name and Number**	
Study Project Manager	Charlie O'Neill	(916) 567-9900

Responsibilities

- Assure that the project is performed in a manner consistent with the CDM Health and Safety Program.
- Assure that the project Health and Safety Plan is prepared, approved, and properly implemented.
- Implement Health and Safety Plan.
- Assure that adequate project resources are allocated to fully implement the project HSP.
- Assure compliance with the Health and Safety Plan by contractor personnel.

- Coordinate with the Corporate Health and Safety Officer on Health and Safety matters.

Title	**Name and Number**	
Site Safety Officer	Rick Kern	(909) 945-3000

Responsibilities

- Direct health and safety activities on-site.
- Report all safety-related incident or accidents to the Corporate Health and Safety Officer and project manager.
- Assist project manager in all aspects of implementing Health and Safety Plan.
- Maintain health and safety equipment on-site.
- Implement emergency procedures as required.
- Conduct health and safety investigations and briefings as needed.

Section 3
Site Information

Six storm water monitoring stations have been installed in the District 3 Tahoe Basin (see vicinity map and site location maps in Attachment 1 at the end of this document). One of these stations monitors a closed conduit storm sewer system located below the highway. The other five stations monitor storm water runoff at double-barrel sediment traps and in drain inlets. Monitoring equipment is installed below grade, within the storm drain system, within the double barrel sediment traps, and in above ground protective enclosures.

Storm water sampling work requires that workers access the stations during storm events on a 24-hour basis. The general safety considerations associated with installation and sample collection at the stations include: traffic hazards, confined spaces, biological hazards, exposure to hazardous materials, limited visibility, fast moving flood waters, heat stress, exposure to cold or freezing temperatures, slippery conditions, and snow management activities conducted by Caltrans.

Section 4
Work Activities Covered by Health and Safety Plan

The objective of this project is to characterize flow and water quality of highway runoff, water quality of precipitation, and characteristics of sediment found in the runoff in the Tahoe Basin. The majority of the fieldwork will consist of crews collecting samples for analysis from all monitoring stations in response storm events. In addition, some fieldwork will be directed toward station set up and periodic station maintenance that would occur during dry conditions; and periodic collection of sediment from double-barrel sediment traps and the effluent filter box.

Field activities at all the monitoring sites will include sample collection (before, during, and after storm events) and general maintenance activities (on going). The hazards associated with all work performed at sampling stations include: (1) being involved in a vehicle accident while driving to or from a site, (2) being struck by a vehicle while working at a site, (3) confined space accidents, (4) experiencing heat and cold stress, (5) being exposed to hazardous materials or vapors, (6) slips, trips, and falls, and (7) muscle strains from moving heavy objects.

Except for sediment sampling equipment, CDM staff and CDM subcontractors will maintain the sampling and monitoring equipment at all sites. Most installation and maintenance procedures at storm drain sampling stations will not require entry into confined spaces. Confined spaces have limited openings for entry and exit, unfavorable natural ventilation which could contain or produce dangerous air contaminants, and are not intended for continuous employee occupancy. All CDM employees and CDM subcontractors who enter a confined space during this project must have had confined-space entry training and a confined-space entry permit as required by the Division Health and Safety Officer.

Sample collection in response to storm events will be performed by CDM staff and CDM subcontractors. Sample collection will involve one or more visits per site during storm events. It is anticipated that one field crew consisting of two people will be adequate for all sites. The general tasks performed by a crew visiting any given site will consist of: (1) driving to the site, (2) establishing traffic control (if needed), (3) interrogating flow monitor and/or sampler, (4) removing and replacing sample bottles, (5) taking grab samples, (6) resetting the sampler, and (7) removing traffic controls and proceeding to the next site. These activities do not require entry into the portion of the drainage system that is underground. Sediment sample collection from the double-barrel sediment traps can be performed with long-reach equipment that does not require entry into the sediment trap.

Section 5
Hazard Assessment

5.1 Chemical Hazards

Although all the monitoring sites are not known to contain hazardous materials, there is a potential for hazardous gaseous and / or liquid contaminants to be present as the result of spills and / or illicit dumping. The presence of chemicals and / or chemical vapors may result in (but is not limited to) one or more of the following threats: toxic conditions, oxygen displacement and explosion and / or fire. The risks associated with these threats include poisoning (acute and / or chronic), asphyxiation, and bodily injury.

5.2 Confined Spaces

The U.S. Occupational Safety and Health Administration (OSHA) classify storm sewers as confined spaces. Regulations for entry into confined spaces are provided in the OSHA Confined Space Standard (Title 29 Code of Federal Regulations (CFR) 1910.146) and in Section 5157 of CalOSHA CCR 8. The risks associated with confined spaces include dangerous atmospheres, engulfment, falls, falling objects, and bodily harm due to explosion. Confined Space Operating Procedures to be used during this project are presented in Section 7.5.

5.2.1 Atmospheric Hazards

Atmospheric hazards that may be present within the storm sewers include oxygen deficiency and toxic or flammable gases. More sewer workers die each year from atmospheric causes than from all other causes combined. Each potential hazard and the recommended evaluation method is presented below:

Oxygen deficiency: Oxygen (O2) deficiency can be caused by the aerobic decomposition of sewage and organic matter. Chemical and biological processes during the decomposition use the available oxygen. Oxygen deficient atmospheres can also result from displacement by gas such as methane or hydrogen sulfide which may or may not be harmful but cannot support life. Oxygen deficiency may be present in areas with little ventilation or air circulation or where biological or chemical processes are occurring. A confined space where water or sewage is enclosed for long periods, and where extensive oxidation of iron (rust) occurs has a high potential for being oxygen deficient.

The normal level of oxygen in the atmosphere is 20.8%. Levels between 19.5% and 20.7% are considered potentially hazardous. An atmosphere legally oxygen deficient contains less than 19.5% oxygen. An atmosphere containing less than 16% oxygen is considered immediately dangerous to life and health (IDLH).

Symptoms of oxygen deficiency include shortness of breath, dizziness, impaired vision, and loss of consciousness.

Hydrogen Sulfide: Hydrogen sulfide (H2S) is a dense, colorless gas that is the byproduct of sewage and organic material that has anaerobically decayed. It has the characteristic odor of rotten eggs. Initially, effects of the gas anesthetizes the sense of smell, and cannot be detected by odor only. Hydrogen sulfide prevents the bonding of oxygen to the hemoglobin molecule contained in the blood cells. Paralysis of the respiratory system is followed by unconsciousness and possibly death.

The eight-hour time-weighted average (TWA) permissible exposure limit (PEL) is 10 ppm. The 15-minute short-term exposure limit (STEL) is 15 ppm. The IDLH concentration is 300 ppm.

Symptoms of hydrogen sulfide poisoning include inflammation of the eyes and lungs, dizziness, loss of coordination, weakness, breathing difficulty, loss of consciousness, and cessation of breathing.

Hydrogen sulfide is often present as a dissolved gas in sewage or can be trapped within sewer sediment and sludge. Disturbing the sediment or sludge can release the trapped or dissolved gas.

Carbon Monoxide: Carbon monoxide (CO) is a colorless, odorless gas that acts as a chemical asphyxiant. It is lighter than air and accumulates beneath manhole covers. It is a product of almost any kind of combustion or hydrocarbon oxidation.

The eight-hour time-weighted average (TWA) permissible exposure limit (PEL) is 35 parts per million (ppm). The 15-minute short-term exposure limit (STEL) is 200 ppm. The IDLH concentration is 1500 ppm.

Symptoms of exposure include headache, dizziness, nausea, weakness, and confusion. In addition the skin becomes cherry red in color.

Methane: Methane (CH4) is a colorless, odorless gas that is lighter than air. It is produced by the chemical decomposition of sewage and organic matter. The gas tends to accumulate beneath manhole covers. Methane is both an asphyxiant and explosive. The lower explosive limit is reached when the concentration of methane reaches 5% of the total atmospheric composition.

Petroleum Hydrocarbons: Petroleum hydrocarbon vapors may enter storm drains as a result of spills or vehicle accidents. If gasoline or diesel fuel odors are present and/or an oily sheen is observed on the water surface within the confined space, employees should leave that space immediately.

5.3 Physical Hazards

5.3.1 Lids

All monitoring stations and double-barrel sediment traps include equipment housing with metal lids that are heavy. Accessing the housing units and sediment traps requires lifting and lowering these heavy steel lids, which if not opened or closed using proper techniques can easily cause injury. Failure to lift and lower these lids in a safe manner can put the worker at risk of crushing fingers, hands, or head. All lids are designed with mechanisms to lock the lid in the open position. The lids must be securely locked to prevent them from closing unexpectedly.

5.3.2 Open Vaults

When the vault at Station 3-201, Tahoe Meadows, is open, it poses a threat to workers and general public. Limited visibility, inattention, poor site control, slips, and/or trips could result in person falling into the vault. The risk associated with such a fall could be bodily injury.

5.3.3 Vehicle Traffic

Traffic hazards will be encountered when working at the side of or in a roadway. These hazards will be increased during times of reduced visibility such as during storm events and at night. The primary threats associated with working in or alongside roadways are workers being struck by passing vehicles or being involved in a vehicular collision. The risk associated with these threats is severe bodily injury and/or death. No work will be performed during snowstorms due to the high risks associated with poor visibility, slippery roads, and snow management activities.

5.4 Cold and Heat Stress

Hazards associated with the outside environment will be encountered when working at the monitoring sites. The primary threats associated with working outside are either cold or warm temperatures. These hazards will increase during times of freezing or near freezing temperatures, rainy conditions, and high levels of physical activity. The threats associated with these hazards are developing hypothermia, heat stress, and frostbite. The risk associated with these threats is decrease in mental capacity, bodily injury and/or death.

5.5 Biological Hazards

Rodents, pathogenic microorganisms, and viruses are potential biological hazards of concern. In addition, a significant potential exists for contact with, and bites from, poisonous brown recluse spiders when crews open the enclosures during a storm event, particularly when lighting is poor. The primary threats associated with these hazards are receiving bites and/or contracting disease. The threats associated with these hazards include flesh wounds and/or infections (acute and/or chronic).

Section 6
General Health and Safety Requirements

6.1 Employee Clearance

When CDM personnel and CDM subcontractors are directly involved in confined space entry activities, a minimum of two employees with an active safety and health clearance status will be present. Active health and safety clearance will consist of a confined space health and safety course approved by the person's employer. The Confined Space Entry Program (CSEP) that applies to any such entry will be that of the employer whose employees actually enter the space. All other field personnel involved in field and/or storm water sampling activities must receive training from the Site Safety Officer before conducting field work.

6.2 Site Safety Meetings

All personnel assigned to perform the work described in this HSP must be (1) given a personal copy of this HSP by a Site Safety Officer, (2) briefed on the health and safety requirements of this HSP by a Site Safety Officer, and (3) must acknowledge receipt of and willingness to comply with the provisions of the plan by signing the Employee Acknowledgment located in Attachment 2. Individuals refusing to sign the agreement will not be permitted to conduct field work for this project. Completed agreements shall be provided to the CDM Project Manager, who will file them with the Project Health and Safety Officer. It is expected that site safety meetings be conducted on two occasions: (1) at a project kick-off meeting to discuss the overall program and (2) just after the crew is mobilized for sampling. Additional briefings should be scheduled and conducted by the Site Safety Officer as needed.

6.3 Incident Reporting

6.3.1 Purpose

All health and safety incidents shall be reported to CDM management and health and safety staff immediately. The prompt investigation and reporting of incidents will reduce the risk of future incidents, better protect all employees, and reduce CDM liability.

6.3.2 Definitions

A health and safety incident is any event listed below:

- Illness resulting from chemical exposure or suspected chemical exposure.
- Physical injury, including both those that do and do not require medical attention to CDM employees or CDM subcontractors.
- Fire, explosions, and flashes resulting from activities performed by CDM and its subcontractors.

- Property damage resulting from activities performed by CDM and its subcontractors.
- Vehicular accidents occurring on-site, while traveling to and from client locations, or with any company-owned vehicle.
- Infractions of safety rules and requirements.
- Uncontrolled chemical exposures.
- Complaints from the public regarding CDM field operations.

6.3.3 Reporting Procedures

Reporting Format
Incident reports shall be prepared by completing an Incident Report Form. This form may be obtained from any CDM Health and Safety Officer and is located in Attachment 2.

Responsible Party
Reports of incidents occurring in the field shall be prepared by the Site Safety Officer or, in the absence of the Site Safety Officer, the supervising field engineer, witness, or injured / exposed individual.

Filing
A report must be submitted to the Health and Safety Officer of the Operating Unit to which the CDM Project Manager belongs within 24 hours of each incident involving medical treatment. In turn, the Health and Safety Officer must distribute copies of the report to the Corporate Health and Safety Officer. When an injury or illness is reported, the Health and Safety Officer must deliver a copy of the report to the individual in charge of Human Resources so that a Worker's Compensation Insurance Report can be filed if necessary. Reports must be received by Human Resources within 48 hours of each qualifying incident.

Major Incidents
Incidents that include fatalities, hospitalization of employees or subcontractors, or involve injury / illness of the public shall be reported to the Health and Safety Officer and CDM Project Manager as soon as possible after emergency authorities (e.g. ambulance) are contacted. Any contact with the media should be referred to the CDM Project Manager and Operating Unit Manager.

6.4 Prohibited On-site Activities

The following are prohibited on-site activities: (1) entering confined spaces without specific training, (2) conducting storm water sampling without clearance from the Site Safety Officer, (3) eating and drinking without prior decontaminating (e.g., washing hands and face), and (4) smoking. Violations of these prohibitions will result in dismissal from the field crew.

Section 7
Site Specific Health and Safety Requirements

7.1 Special Medical Tests

Special medical tests will not be required for any of the work activities proposed in this plan.

7.2 Special Training

Installation of sampling and flow monitoring equipment and some station maintenance activities may require confined space entry. Confined space entry requires specific training. Under no circumstances will personnel be allowed to enter a confined space without training approved by their employer.

7.3 Physical Hazards

7.3.1 Housing Lids and Open Vaults

All monitoring stations require opening lids on the housing units to gain access to the equipment during maintenance activities and to retrieve grab samples during sampling activities. In addition, sediment trap barrels are covered with heavy metal lids. The housing and sediment trap lids are very heavy and can easily break a finger or wrench a back if not lifted or lowered correctly. Each field crew will be instructed on how to properly open a lid, lock the lid in the open position, and lower the lid.

The housing lids are raised by lifting up on the handles in the front and then with a firm grasp of the lid, walking along the side of the unit until the lid is fully extended. Hinges on either side of the lid must both be locked into place. The lid should be held up by one crewmember until both hinges are locked by the second crewmember. To lower the lid, one crewmember holds on to the lid, while the second member releases each hinge. The lid is slowly lowered by both crewmembers. Just before the lid closes, one member releases his or her grasp and the other member completes the closure.

The sediment trap lids are opened by lifting the lid over the unlocked latch, and rotating the lid to the side of the trap. The lid is closed in a similar fashion.

Opening the lid at the underground vault or sediment trap creates a new hazard. A fall into the open vault or sediment trap may result in serious injury. The area around an open vault or sediment trap may need to be cordoned off from the general public by using barricades and/or traffic cones. All field crewmembers must be informed before the vault is opened. Each sampling crew will keep access control equipment (cones, barriers and tape) in its sampling crew vehicle throughout the duration of the project.

7.3.2 Work Site and Traffic Control

Work site control and work zones will be established each time a crew visits a sampling station. Field crews will use traffic control cones, warning signs, and vehicles to develop work zones and site control at sites where the safety of crews and the public may be threatened. An example of this would be the use of traffic cones to direct pedestrians away from an open manhole where vehicle traffic control is not required. Site specific protocols for proper vehicle and traffic safety in relation to a given sampling station are provided in Attachment 3. Actual field conditions may require modification of the directions. Modifications, if any, will be made by the Site Safety Officer who will then inform the Project Health and Safety Officer.

Traffic hazards pose the greatest risk to workers visiting sampling stations. Traffic hazards to both workers and motorists must be minimized at each sampling station. Standard traffic control measures, which can be used to reduce traffic hazards, are described below. However, sampling sites may be located in areas where standard traffic measures may not be applicable. In these cases, standard control measures will be modified to meet a given situation.

Warning signs (i.e., Utility Work Ahead, Lane Closed, etc.) shall be erected on the roadway or shoulder and shall be removed upon termination of work. Portable signs shall be erected vertically, with the bottom of the sign a minimum of 18 inches above the roadway. Portable signs shall be illuminated at night and/or be accompanied by a flashing yellow light. Traffic cones or pylons shall be placed on the roadway to divert traffic away from the manhole opening. These cones must have reflective striping in order to be visible at night. The cone taper distance from the manhole shall be determined by the following equation when speed limit is 40 MPH or less:

$$L = (WS^2) / 60$$

where L = pylon taper length in feet
W = width of desired closure or offset (feet)
S = posted speed limit (miles per hour)

(Adopted from Manual on Uniform Traffic Control Devices, 1988)

Table 7-1 shows taper lengths for various traffic speeds with 5 and 10 foot wide lane closure. A lane closure pertains only to traffic lanes and does not include shoulders other areas outside the main traffic flow. The site plans have been developed with these criteria.

Table 7-1
Traffic Cone Taper Lengths

Width of Closure (feet)	Traffic Speeds (mph)	Cone Taper Length (feet)
5	25	52
	30	75
	35	102
	40	133
10	25	104
	30	150
	35	204

Employees should not rely on traffic warning devices, like cones or saw-horses, for protection against oncoming traffic. CDM encourages work teams to place one or more vehicles between them and the direction from which traffic flows.

7.4 Hazardous Materials Identification and Protection

Storm water and storm water sewer systems have some potential to contain hazardous materials and/or microorganisms and should be approached with caution. Industrial and commercial areas are of particular concern because of possible illegal dumping of wastes into the storm sewer system. Any unusual smells and/or discolored sample water are definitely cause for alarm. The following procedures are recommended to help protect field personnel from these hazards:

- If field crews detect or suspect any dangerous situations they must notify the Site Safety Officer of their intended protective procedures.

- Field personnel should wear chemically resistant gloves when handling storm water samples. It is important to realize that storm water can contain dangerous constituents regardless of land use type. For example, storm water typically has high concentrations of bacteria. All crew members who come into contact with storm water must decontaminate. This is especially important prior to eating and drinking or smoking. All personnel must also decontaminate before leaving the site. Proper decontamination techniques will ensure that contamination will not spread to vehicles or other locations. Decontamination should include disposal of gloves and washing the hands and face with soap and water. Each crew shall carry 5-gallon containers containing wash/drinking water and antibacterial wipes or lotion. All crew members must be careful to not contaminate the container.

7.5 Confined Space Standard Operating Procedure

Storm sewers are defined by OSHA as confined spaces and are therefore subject to federal regulation. Each employer providing personnel for confined space entry will have its own written CSEP. A copy of this program will be submitted to the HSO prior to the start of work. All CDM employees will comply with CDM's confined

space entry requirements and procedures, which are included in Attachment 4. All CDM subcontractors will comply with their confined space entry requirements and procedures.

The anticipated level of hazard will determine procedures for entries as defined below.

Low Hazard Entries

Definition: Includes any storm water system where there is clearly no potential for connection to a sewer system, and the storm water system is dry. It should be noted that the presence of mud at the bottom of a channel is evidence that the system is not dry. Under dry conditions, no potential for exposure to volatile contaminants is anticipated. Entries must be completed when there is no precipitation forecasted.

Procedure: Use 4-gas meter to monitor all levels of the space. Verify that the instrument has been calibrated to alarm at the action level, and document all readings. If explosive levels are below 10% of the LEL, oxygen content is between 19.5% and 22%, hydrogen sulfide is less than 5 ppm, and carbon monoxide concentrations are below 15 ppm, and no other hazards are anticipated, entry may proceed. No CSE permit is required. Fall protection is required for all entries with a vertical drop of greater than 6 feet. A ladder may be used in place of fall protection only if it is in full compliance with the OSHA standard.

Moderate Hazard Entries

Definition: Includes any storm water system where there is clearly no potential for connection to a sewer system, but the system contains liquids, and therefore may contain unknown volatile contaminants. Entries must be completed when no precipitation is forecasted.

Procedure: The standard confined space entry form will be used for approval and termination of entry. Emergency communications and use of an attendant will be required. Fall protection requirements will be the same as the low hazard entry. The space must be ventilated prior to and during entry. Entries into these spaces by CDM personnel require prior completion of the CDM permit form and approval by a CDM confined space entry coordinator.

High Hazard Entries

Definition: This includes sewers, entries when there is a potential for precipitation and any entries where additional hazards are anticipated.

Procedure: The confined space entry standards must be fully implemented. The CDM Project HSO will coordinate with the project manager to prepare the entry permit.

It is very important to notify all members of the field crew when hazardous situations are encountered. In general, the notification process will consist of notifying the Site Safety Officer. This individual, will in turn, notify higher levels of CDM management. However, if the Site Safety Officer is not available the CDM Project Manager must be contacted.

7.6 Site Illumination

This project will likely require personnel to work at night. Portable lighting shall be used to achieve sufficient illumination. CalOSHA (8 CCR 3317) requires 2-foot candles of illumination for the type of work covered by this plan. Vehicle lights, headlamps, and flashlights will be used to meet this requirement.

7.7 Biological Hazards

Field crews must protect themselves from biological hazards they may be exposed to during sampling activities. Bacteria and other micro-organisms may potentially be present in collected storm water samples. Crews should protect themselves by using disposable nitrite or latex gloves when handling storm water samples. Crews should also avoid hand to mouth and hand to eye contact until they have had a chance to wash their hands. Eating and drinking will not be allowed until proper decontamination has occurred.

There is also the possibility of exposure to either wild or domestic animals. Crews should avoid these animals since they may carry rabies or other diseases and they are capable of infecting serious wounds.

7.8 Environmental Hazards

Field crews must protect themselves from hazards associated with environmental conditions, such as cold temperatures, heat stress, and rain. Crews should protect themselves from heat stress by avoiding work during the hottest part of the day, drinking plenty of water, resting frequently, wearing light breathable clothes, and wearing a hat. When working during periods of cold temperatures (below 10 degrees Centigrade), crew members should dress in layers of warm clothing, avoid keeping their hands and head exposed for long periods of time, minimize the time spent outside of protected areas. When working during periods of rain, crewmembers should wear waterproof clothing and boots to avoid getting their underclothes wet. At the first signs of becoming overheated or very cold, crewmembers should seek shelter until their body temperature returns to near normal.

No on-site work will be performed when it is snowing and Caltrans is performing snow management activities. Overall conditions are too dangerous to be working along side an active traffic lane under this condition.

7.9 Personal Protective Equipment

Protective equipment shall be used and shall consist of the following:

- Hardhat
- Reflective safety vest
- Rubber boots with steel toes (when needed)
- Rain Gear (when needed)
- Cold weather gear such as hat, gloves, boots, coat, pants (when needed)
- Nitrile or latex gloves
- Splash proof goggles (if desired)

In addition, a first aid kit will be present in each vehicle used for field work. It is the responsibility of field crew leaders to be sure their vehicles have a first aid kit and cellular telephone before entering the field.

Section 8
Emergency Response Procedures and Location of Nearest Hospitals and Fire Departments

In the event of an injury, illness, or accident that may require the attention of a physician, the Site Safety Officer(s) must be notified immediately. In the event of emergency, the CDM Task Order Manager and the CDM Project Corporate Health and Safety Officer will also be notified immediately:

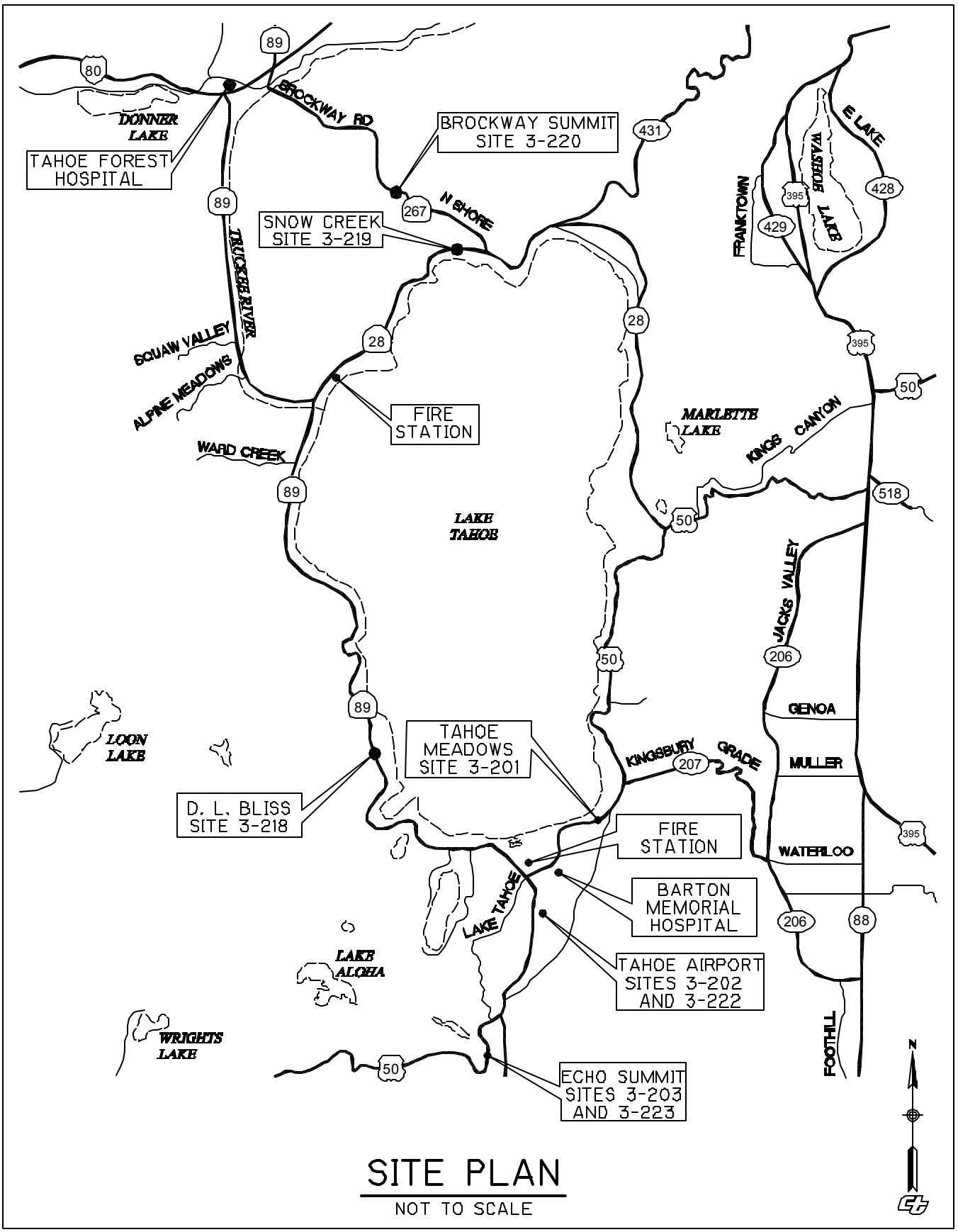
- CDM Task Order Managers: Charlie O'Neill (916) 567-9900
  916-202-8571 (cell)
- CDM Corporate H&S Officer: Chris Marlowe (732) 225 - 7042 x 332
  (800) 313 - 5593 (pager)

If a person(s) is transported to a medical facility, the location of this facility must be given to the Site Safety Officer. In emergency situations, field personnel should call 911 for an emergency response team. All CDM employees and subcontractors must be familiar with the location of and route to the nearest hospital. Location maps and routes to local hospitals and fire departments are provided in Attachment 1 and must be carried in the field vehicle at all times.

Table 8-1
Site and Hospital Locations

Monitoring Site	*Hospital Location*	*Hospital Phone Number*	*Fire Department Location*	*Phone Number*
Echo Summit (3-203 & 3-223)	Barton Memorial Hospital 2170 South Avenue South Lake Tahoe, CA (corner of South & 3rd)	(530) 541-3420	2101 Lake Tahoe Blvd (Highway 50) South Lake Tahoe	911
Tahoe Airport (3-202 & 3-222)				
Tahoe Meadows (3-201)				
D. L. Bliss (3-218)				
D. L. Bliss (3-218)	Tahoe Forest Hospital 10121 Pine Avenue Truckee, CA	(530) 587-6011	300 North Lake Blvd. Tahoe City, CA	911
Snow Creek (3-219)				
Brockway Summit (3-220)				

Attachment 1
Vicinity Map and Emergency Service Location Maps



SITE PLAN

NOT TO SCALE

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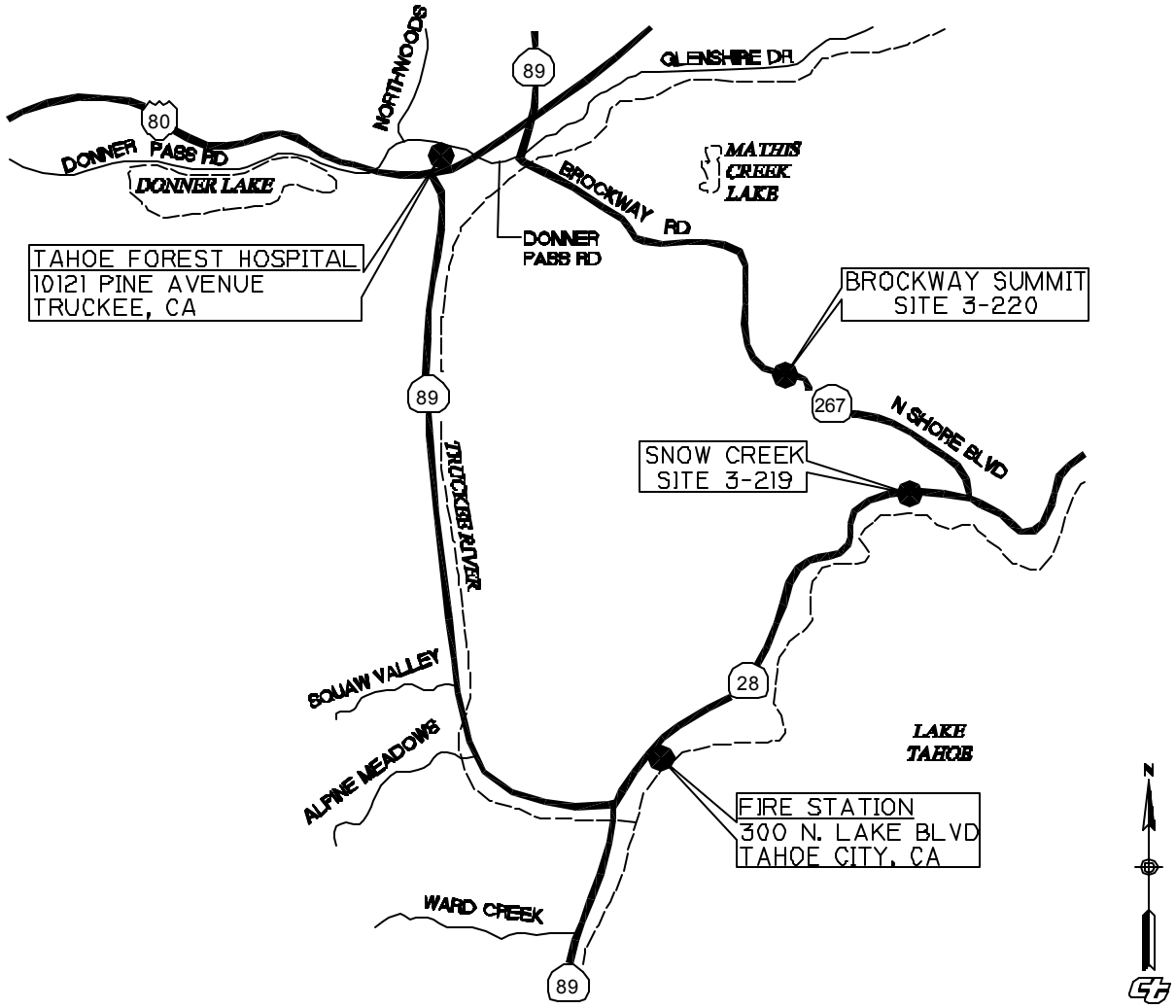
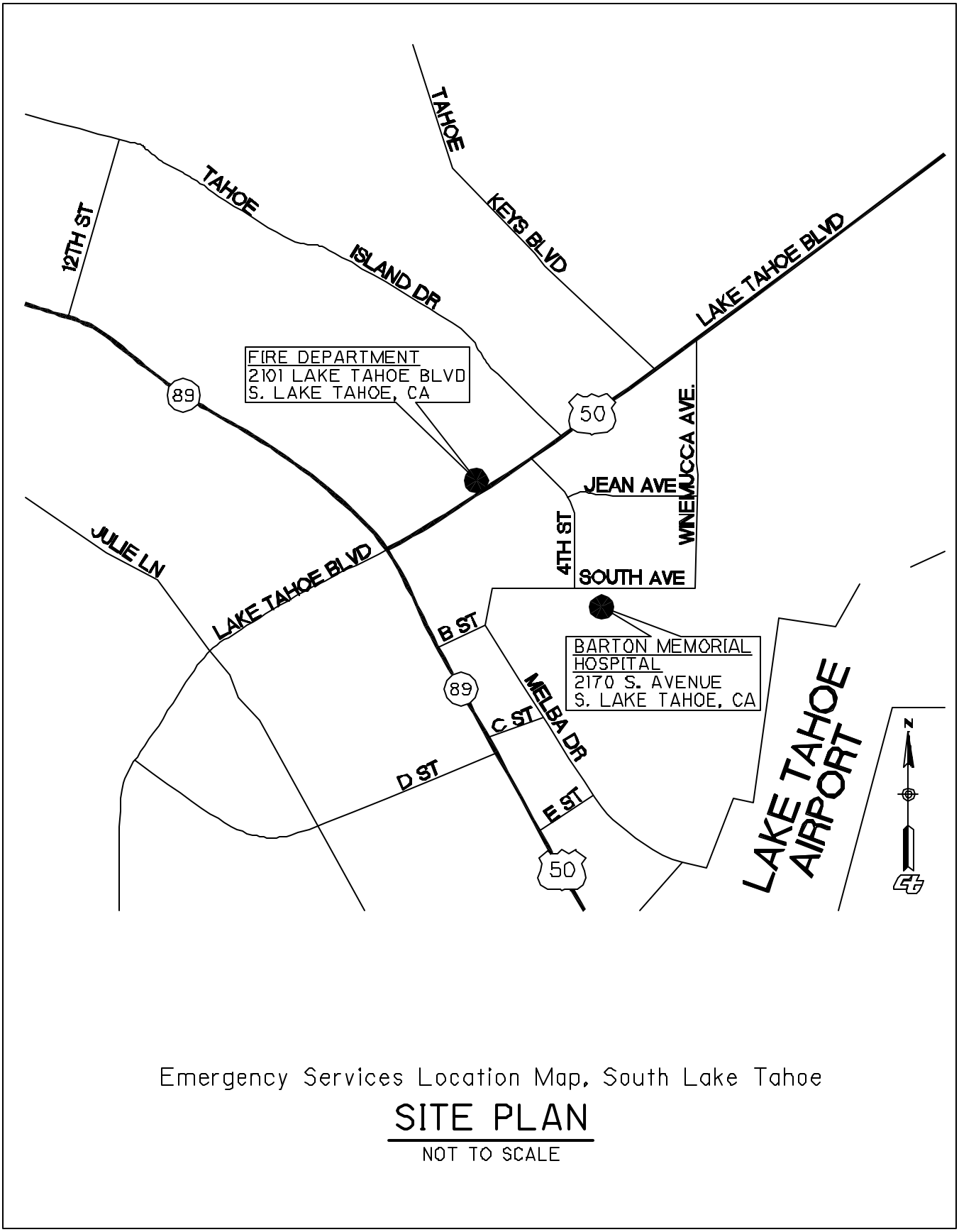


Emergency Services Location Map, North Lake Tahoe

SITE PLAN

NOT TO SCALE



Emergency Services Location Map, South Lake Tahoe

SITE PLAN

NOT TO SCALE

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Attachment 2
Employee Acknowledgement
Injury / Illness Report

Employee Acknowledgment

(Please sign, detach and return to CDM Project Manager)

I hereby certify that I have read and understand the safety and health guidelines contained in Caltrans Tahoe Basin Water Quality Characterization and Sediment Trap Effectiveness Studies Health and Safety Plan.

Employee Name

Signature Date

In case of emergency, please contact:

1.

Name Relationship Phone Number

2.

Name Relationship Phone Number

Received by:

Site Safety Officer

Signature Date

CDM Employee Injury or Exposure Incident Report

EMPLOYEE DATA:

Name _____ Business Unit _____

Address _____ Office Location _____

_____ Occupation _____

Home Phone _____ Marital Status _____

Soc. Sec. # _____ Date of Hire _____

Birth Date _____ Date of Report _____

INJURY/ILLNESS INFORMATION:

Location of Incident **Office** **Field** **Public Space** **Plant**

Site Name and Address _____

_____

Operation in Process _____

INCIDENT TYPE: Exposure ( ) Injury ( )

Possible Exposure ( ) Near Miss ( )

Date of Incident: _____

Time of Incident: _____

SOURCE OF HAZARD OR HARM *(e.g. Machine, Auger, Car, Chemical Substance)*

INJURED OBJECT OR BODY PART *(e.g. Arm, Leg, Lungs, Shoe, Crew Vehicle)*

NATURE OF LOSS *(e.g. Cut, Burn, Fracture, Headache, Property Damage*

DESCRIBE HOW INJURY/ILLNESS OCCURRED *(e.g. Struck by…Fell from…Exposed to…)*

SITE CONDITIONS AT TIME INCIDENT:

Temperature _____ Humidity _____

Wind Speed & Direction _____ Cloud Cover _____

Precipitation _____ Other _____

Physician Name and Address

Hospital Name and Address

MEDICAL CARE RECEIVED *(when, where, by whom):*

PHYSICIAN'S COMMENTS: *(Attach Physicians' Report(s), if any).*

HAS INCIDIENT RESULTED IN:

Loss of Work Time	( )	*If Yes, Enter Below (Actual or Anticipated):*	
Number of Days Lost		*Date of Return to Work*	
Death	( )	Permanent Disability	( )
Temporary Disability	( )	Property Damage	( )
Other Type of Loss	( )	Explain:	

HEALTH AND SAFETY ISSURES (If applicable)

MATERIALS EXPOSED TO *(chemical compound name, physical state, etc.):*

OTHER INDIVIDUAL(S) INVOLVED OR AFFECTED:

WITNESSES TO THE INCIDENT:

WAS OPERATION SUBJECT TO AN APPROVED SAFETY PLAN OR PERMIT?

YES ( ) Reference _____

NO ( ) Explain _____

WAS INJURY/ILLNESS/EXPOSURE DUE TO FAILURE OF PROTECTIVE EQUIPMENT?

YES ( ) NO ( ) Explain _____

_____

POSSIBLE CAUSES OF INJURY OR EXPOSURE:

HAS HSM BEEN NOTIFIED? NO ( ) YES ( )

_____ _____

Employee Signature **Date**

HSM COMMENTS:

ACTION REQUIRED:

Attachment 3
Monitoring Site Specific
Safety Information Sheets

CDM Site Safety Inspection
Project: Tahoe Basin Water Quality Characterization and Sediment Trap Effectiveness Studies
Location: Highway 50 near Echo Summit
Site 3-203 and 3-223

Activities

Collection of stormwater runoff, sediment, and precipitation samples using both automated equipment and manual techniques. Installation and maintenance of automated equipment and monitoring site will also be performed.

Site Description

Parking – The monitoring / maintenance crew will park in the emergency lane turnout adjacent to the storm water drain inlet being used for sample collection.

Facility – The facility is within Caltrans Highway 50 right-of-way (ROW). The monitoring equipment is housed in a locked metal enclosure attached to a wooden platform outside the limits of the emergency turnout. Sample collection inlet / tubing and the monitoring station (MS) flow measurement devices are installed in the sediment trap.

Safety Hazards

- Entering the emergency turnout either by turning left in front of cross traffic or turning right into the parking area. Re-entering the highway travel lane from the emergency turnout.
- Behind the storm water inlet facility and the MS, the terrain is rocky and slopes down and away at 1:1.
- The wooden platform the equipment enclosure sits on has a one-foot pad to stand on in front and only a few inches around the sides.
- Likely to have snow, sleet and fog at this MS.
- Poisonous spiders and other vermin / insects may be present.

Recommendations

- The monitoring crew will be traveling west from Lake Tahoe to the MS, hence they will turn left across the eastbound travel lane. There is a good line of sight on this section of Hwy 50 that allows for a safe turn across the eastbound travel lane in good weather conditions. Traffic along this stretch was observed to be moving at 50 to 60 mph during the safety inspection. As an alternative during heavy traffic or adverse weather, the monitoring crew can proceed to Echo Summit where it may be safer to turn left across traffic and reenter the highway in the east-bound direction.

- At night use battery operated lanterns. Use extreme caution when accessing equipment in the enclosure, there is no platform footing for service personnel to stand on, a slip or misstep around the MS could result in a fall down the steep side slope and a potential serious injury.
- During operation and maintenance of the sample station, place a few traffic cones in the emergency lane (next to the curb) approximately 50-feet behind the emergency turn-out. Park the vehicle in front of the storm drain inlet and MS, i.e. use as a shield especially when performing maintenance on the sample tubing inlet. Keep emergency and vehicle strobe lights on during serving.
- Poisonous spiders and other vermin inhabit these areas, be aware and use gloves when possible.
- At night use battery operated lantern with 360-degree illumination.
- A team member during maintenance or when a crewmember has his/her back to traffic should be watching traffic.
- Always wear hardhats, steel toed boots, and safety vests.

CDM Site Safety Inspection
Project: Tahoe Basin Water Quality Characterization and Sediment Trap Effectiveness Studies
Location: Highway 50 near Tahoe Airport
Site 3-202 and 3-222

Activities

Collection of stormwater runoff, sediment, and precipitation samples using either automated equipment or manual techniques. Installation and maintenance of automated equipment and monitoring site will also be performed.

Site Description

Parking – The monitoring / maintenance crew will either pull off the road, transition over the 6-inch curb and park adjacent to the monitoring station (MS) or park in the dirt parking lot across Hwy 50.

Facility – The facility is within Caltrans Highway 50 right-of-way (ROW). The monitoring equipment is housed in a locked metal enclosure attached to a wooden platform five feet from the Hwy 50 asphalt curb and 10-feet from the travel lane. Sample collection inlet / tubing and the monitoring station (MS) flow measurement devices are installed in the sediment trap.

Safety Hazards

- Exiting Hwy 50 from the eastbound travel lane and parking next to the MS is potentially hazardous. Highway 50 at the MS is a two-lane highway with three-foot emergency lanes on each side of the road. O&M crews parking next to the MS will have to come to a near stop in the travel lane to jump the curb and pull in next to the MS.
- If the operation and maintenance (O&M) crew parks the service vehicle across the street, they will have to walk across Hwy 50 carrying equipment and supplies. Weather conditions may be adverse during MS O&M crossing, i.e. rain, sleet, snow, fog or icy conditions. Work at night time would compound adverse weather conditions. Additionally, when crossing from the MS back to the parking lot, the view of oncoming traffic is blocked approximately 100-feet west of the MS.
- As stated above, from the MS the view of oncoming traffic is blocked by vegetation 100-feet west of the MS. Traffic speeds observe during site safety inspection ranged from 45 to 55 mph (66 to 81 fps).
- The platform that the equipment enclosure sits on has a one-foot pad to stand on in front and only a few inches around the sides.
- Likely to have snow and sleet at this MS.
- During snow conditions be aware of buried rocks and changes in grade.
- Snowplow activities.
- Poisonous spiders and other vermin / insects may be present.

Recommendations

- Before performing MS operation and maintenance, the monitoring crew should set up a "MEN AT WORK" (see Caltrans Specifications) sign 200-feet before the vegetation at the road dogleg that blocks the view towards the MS. Activate the vehicle strobe and emergency lights after setting up the warning sign, maintain a safe speed that will allow a safe exit from Hwy 50, the transition over the asphalt curb and stopping adjacent to the MS. When re-entering the travel lane from the MS, ease part of the vehicle into the emergency lane, when traffic is clear pull into the travel lane, be prepared for a fast acceleration if traffic appears from the blind spot. Keep emergency and vehicle strobe lights on during servicing.
- When parking across the highway from the MS a clear view of the highway around the dog-leg west of the MS and the highway east of the MS is available. Don't take chances in adverse weather conditions, wait until traffic is clear in both directions before crossing Hwy 50.
- Set traffic cones at 15-foot intervals in the emergency lane and in front of the MS. Keep emergency and vehicle strobe lights on during servicing. When O&M personnel are lying on the ground servicing the MS sample inlet equipment, a team member should be watching traffic at all times.
- At night use battery operated lanterns. Use caution when accessing equipment in the enclosure, there is no platform footing for service personnel to stand on, a fall around the MS could result in injury.
- Poisonous spiders and other vermin inhabit these areas, be aware and use gloves when possible.
- Be aware of snowplow activities during MS activities – always watch the traffic!
- Always wear hardhats and safety vests.

CDM Site Safety Inspection
Project: Tahoe Basin Water Quality Characterization and Sediment Trap Effectiveness Studies
Location: Highway 50 near Tahoe Meadows
Site 3-201

Activities

Collection of stormwater runoff samples using automated equipment. Installation and maintenance of automated equipment and monitoring site will also be performed.

Site Description

Parking – The monitoring / maintenance crew should attempt to park between the bike path and Highway 50, without blocking traffic into Tahoe Meadows or the bike path.

Facility – The facility is within Caltrans Highway 50 right-of-way (ROW). The monitoring equipment is housed in a locked metal vault enclosure adjacent to Highway 50. Sample collection inlet / tubing and the monitoring station (MS) flow measurement devices are installed the storm drain pipe.

Safety Hazards

- Entering Tahoe Meadows (Lake Rd) from Highway 50, while observing bike and foot traffic along the bike path. Re-entering Highway 50 from Tahoe Meadows.
- Heavy traffic (Hwy 50 and residential), bikes, and people.
- Entering / exiting the metal vault structure.
- Likely to have snow, sleet and fog at this MS.
- Poisonous spiders and other vermin / insects may be present.
- Water or snow inside the vault.
- Snowplow activities.
- Vehicle traffic entering / existing Tahoe Meadows facility.

Recommendations

- The monitoring crew will be traveling east or west on Hwy 50 to access the MS, hence they will turn left across the westbound travel lane or they will turn right onto Lake Road. There is a good line of sight on this section of Hwy 50 that allows for a safe turn across the westbound travel lane in good weather conditions. Traffic along this stretch was observed to be moving at 30 to 40 mph during the safety inspection. During adverse weather conditions or heavy traffic, the monitoring crew should access the MS from the westbound travel lane, which will minimize any potential traffic accidents.

- At night use battery operated lanterns. Use extreme caution when accessing equipment in the vault; a slip or misstep around the MS could result in a fall and a potential serious injury.
- Poisonous spiders and other vermin inhabit these areas, be aware and use gloves when possible.
- Use a step ladder to enter and exit the housing vault.
- At night use battery operated lantern with 360-degree illumination.
- A team member during maintenance or when a crewmember has his / her back to traffic should be watching traffic.
- Always wear hardhats, steel toed boots, and safety vests.

CDM Site Safety Inspection
Project: Tahoe Basin Water Quality Characterization and Sediment Trap Effectiveness Studies
Location: Highway 89 at D.L. Bliss State Park
Site 3-218

Activities

Collection of stormwater runoff samples using automated equipment. Installation and maintenance of automated equipment and monitoring site will also be performed.

Site Description

Parking – The monitoring / maintenance crew will exit Hwy 89 (north or south bound) and park in the paved turnout (next to boulders). Field crews shall access the MS by foot from the paved turnout.

Facility – The MS is within Caltrans Highway 89 right-of-way. The monitoring and sampling equipment are housed in a locked metal enclosure attached to a wooden platform approximately 5 -10 feet from the highway. Sample collection inlet / tubing and the MS flow measurement devices are installed in the sediment trap.

Safety Hazards

- Exiting Hwy 89 traffic.
- Road conditions along Hwy 89 (i.e. black ice).
- Adverse weather conditions while monitoring or O&M activities (i.e. rain, sleet, snow, fog or icy conditions).
- Work at nighttime compounded with adverse weather conditions.
- The platform that the equipment enclosure sits on.
- During snow conditions be aware of buried rocks and changes in grade.
- Snowplow activities.
- MS exposed – could easily be struck by an automobile.
- Poisonous spiders and other vermin / insects may be present.

Recommendations

- Emergency and vehicle strobe lights should be on prior to exiting / entering Hwy 89 (at least 200 – 300 feet).
- Set traffic cones around all field crew vehicles and use emergency and vehicle strobe lights appropriately.

- When O&M or field personnel are servicing the MS or related equipment, a team member should be watching traffic at all times.
- At night use battery operated lanterns.
- Use caution when accessing equipment in the enclosure or working around the wood platform.
- Poisonous spiders and other vermin inhabit these areas, be aware and use gloves when possible.
- Be aware of snowplow activities during MS activities – always watch the traffic!
- Be aware of slip, trip, and fall conditions.
- Be aware of traffic during adverse weather conditions – black ice.
- Be aware of environmental conditions – avalanches.
- Always wear hardhats, steel-toe boots and safety vests.

CDM Site Safety Inspection
Project: Tahoe Basin Water Quality Characterization and Sediment Trap Effectiveness Studies
Location: Highway 28 at Snow Creek
Site 3-219

Activities

Collection of stormwater runoff and precipitation samples using automated equipment. Installation and maintenance of automated equipment and monitoring site will also be performed.

Site Description

Parking – The monitoring / maintenance crew will exit Hwy 28 and park in the adjacent parking lot (former real estate office). Field crews shall access the MS by foot from the parking lot.

Facility – The MS is within Caltrans Highway 28 right-of-way. The monitoring equipment will be housed in a locked metal enclosure attached to a wooden platform approximately 10 to 15 feet from the highway. Sample collection inlet / tubing and the MS flow measurement devices are installed in the drain inlet and outfall pipe.

Safety Hazards

- Exiting and entering Hwy 28 traffic.
- Adverse weather conditions while monitoring or O&M activities (i.e. rain, sleet, snow, fog or icy conditions).
- Work at nighttime compounded with adverse weather conditions.
- The platform that the equipment enclosure sits on.
- During snow conditions be aware of buried rocks and changes in grade.
- Snowplow activities.
- People accessing the MS area (foot and bike traffic).
- Adjacent Creek and overhead power lines.
- MS is located within a flood zone.
- Poisonous spiders and other vermin / insects may be present.

Recommendations

- Emergency and vehicle strobe lights should be on prior to exiting / entering Hwy 28 (200 – 300 feet).

- Set traffic cones around all field crew vehicles and use emergency and vehicle strobe lights appropriately.
- When O&M or field personnel are servicing the MS or related equipment, a team member should be watching traffic at all times.
- At night use battery operated lanterns.
- Use caution when accessing equipment in the enclosure or working around the wood platform.
- Poisonous spiders and other vermin inhabit these areas, be aware and use gloves when possible.
- Be aware of snowplow activities during MS activities – always watch the traffic!
- Be aware of slip, trip, and fall conditions.
- Be aware of rising water levels in neighboring creek.
- Always wear hardhats, steel-toe boots and safety vests.

CDM Site Safety Inspection
Project: Tahoe Basin Water Quality Characterization and Sediment Trap Effectiveness Studies
Location: Highway 267 below Brockway Summit
Site 3-220

Activities

Collection of stormwater runoff samples using automated equipment. Installation and maintenance of automated equipment and monitoring site will also be performed.

Site Description

Parking – The monitoring / maintenance crew will exit Hwy 267 and park on an unpaved service road. Walking overland from the road to the station or south along the HY 267 shoulder accesses the MS.

Facility – The MS is within Caltrans Highway 267 right-of-way. The monitoring equipment will be housed in a locked metal enclosure attached to a wooden platform approximately 20 feet from the highway. Sample collection inlet / tubing and the MS flow measurement devices are installed in the drain inlet and outfall pipe.

Safety Hazards

- Exiting and re-entering Hwy 267.
- Adverse weather conditions while monitoring or O&M activities (i.e. rain, sleet, snow, fog or icy conditions).
- Work at nighttime compounded with adverse weather conditions.
- Traffic along Hwy 267.
- The platform that the equipment enclosure sits on.
- During snow conditions be aware of buried rocks and changes in grade.
- Snowplow activities.
- Poisonous spiders and other vermin / insects may be present.
- People accessing the MS area.

Recommendations

- Emergency and vehicle strobe lights should be on prior to exiting / entering Brockway (200 – 300 feet).
- Set traffic cones around all field crew vehicles and use emergency and vehicle strobe lights appropriately.

- When O&M personnel are servicing the MS or related equipment, a team member should be watching traffic at all times.
- At night use battery operated lanterns.
- Use caution when accessing equipment in the enclosure or working around the wood platform.
- Poisonous spiders and other vermin inhabit these areas, be aware and use gloves when possible.
- Be aware of snowplow activities during MS activities – always watch the traffic!
- Be aware of slip, trip, and fall conditions.
- Always wear hardhats, steel-toe boots and safety vests.

Attachment 4
Camp Dresser & McKee Inc.
Confined Space Entry Procedures

CDM

CONFINED - SPACE

ENTRY PROCEDURES

October 28, 2002

CDM CONFINED-SPACE ENTRY PROCEDURES

October 28, 2002

PURPOSE

This program establishes requirements for safe entry into, work in, and exit from, confined spaces such as wet wells, manholes, tanks and vessels, or pipelines. Camp Dresser & McKee (CDM) employees or subcontractors may enter a confined space only when these confined space entry procedures are followed.

Confined spaces are dangerous because gases and vapors can accumulate to form oxygen deficient, explosive, or toxic atmospheres. Although CDM can't place signs on spaces belonging to its clients, entry into the following is considered confined-space entry (CSE) unless these procedures provide otherwise.

Tanks	Vessels
Manholes	Pipelines
Water transmission lines	Tunnels
Stilling wells Junction structures	
Valve and metering vaults	Un-ventilated dry wells
Limited-access wet wells	Sewers

Some confined spaces may or may not require a permit, depending on the circumstances. CDM treats trenches, vaults, pits, or diked areas as confined if they pose a potential for trapping a toxic atmosphere. Only operating unit CSE coordinators may determine that work in such a space does not need a permit. A dry well or pipe gallery that becomes hazardous only when a pipe ruptures is an example of a space to which the CSE Coordinator might decide these procedures do not apply.

When the air in the space presents no hazard, and the physical hazards can be controlled without entry, employees may, with coordinator approval, use the low-hazard entry permit described later in this procedure. The types of space in which this procedure will probably apply include; clear wells, sedimentation basins, equalization basins, rapid mix tanks, flocculation tanks, sand filters, and water plant clarifiers. Although employees who have not completed CDM s confined space entry course may perform a low - hazard entry, at least one employee with the training should have seen the space and reviewed the permit.

-Space Classification Table). In general, CDM personnel will not perform work in type A spaces where conditions could be immediately dangerous to life or health. CDM personnel may perform work in type B spaces or in type C spaces, in accordance with these procedures.

4. Emergency. Any occurrence (including any failure of hazard control or monitoring equipment) or event(s) internal or external to the confined space which could endanger entrants.

5. Engulfment. The surrounding and effective capture of a person by a liquid or finely divided solid substance.

6. Entry. The act by which a person intentionally passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and occurs when any part of the entrant's body breaks the plane of an opening into the space.

7. Hot Work. Operations which could provide a source of ignition, such as riveting, welding, cutting, burning, or heating.

8. Immediately Dangerous to Life or Health (IDLH). Any condition which poses an immediate threat of loss of life; may result in irreversible or immediate-severe health effects; may result in eye damage; irritation or other conditions which could impair escape from the confined space.

9. Inerting. Rendering the atmosphere of a confined space nonflammable, non-explosive or otherwise chemically non-reactive by such means as displacing or diluting the original atmosphere with a gas that is non-reactive with that space.

10. Isolation. The process by which a confined space is completely protected from the release of energy or material. Isolation is usually accomplished by such means as blanking or blinding; removal or mis-alignment of pipe sections or spool pieces; double block and bleed; or lock-out and/or tag-out.

11. Limited or Restricted Means of Entry or Exit exist when the entry occurs while crawling, through a manhole, by a ladder, or on a rope. Entries on grade, through doorways, or on stairways that meet OSHA standards are not restricted.

12. Not Designed for Continuous Employee Occupancy. Spaces which are designed for filling with liquids or solids or contaminated air. Most spaces with continuously operating ventilation and lights are designed for human occupancy.

13. Oxygen Deficient Atmosphere. An atmosphere containing less than 19.5 percent oxygen by volume.

l. Oxygen Enriched Atmosphere. An atmosphere containing more than 22 percent oxygen by volume.

PROGRAM SUMMARY

No CDM employee may enter a confined space unless these procedures (or equivalent procedures approved by the coordinator) are followed. CDM's CSE program includes:

- Training for confined-space team members.
- Medical clearance and immunization.
- Preparation and review of pre-entry permits.
- Required appropriate safety equipment.
- Subcontractor accountability
- Monitoring for hazardous conditions.
- Standard operating procedures for entries.
- Ventilation of hazardous gases.
- Rescue procedures and equipment.
- Annual review of CSE permits and program.

Once a year, or more often as needed, CDM's Health and Safety Managers will review the canceled permits and address any problems that have been observed since the last review.

CDM work teams who perform entries at client facilities shall coordinate their schedule and entry procedures with the client if its employees could be affected by the entry. They shall

also offer to explain our procedures to the client.

Although client and subcontractor personnel may participate with CDM personnel in a confined-space entry, this program is for the protection of CDM employees. Clients and subcontractors may use these procedures only if they accept all liability for their use. CDM subcontracts that require non-CDM personnel to enter confined spaces in the absence of CDM employees should include CDM s protocol for confined space entries by subcontractors (Available from Health and safety group.)

ROLES AND RESPONSIBILITIES

Unless the CSE coordinator determines that liquids or gases are neither present in nor can enter the space during the work period, entry by team members requires--at a minimum--people who fill three roles:

Entry Attendant(s) Confined-Space Entrant(s) Rescuer(s)

CDM achieves confined-space safety principally through a detailed plan of cooperation between team personnel in the roles listed in table 1, below.

TABLE 1 ENTRY TEAM REQUIREMENTS

Position	Qualification
CSE Coordinator	A CDM employee, trained and authorized by the corporate H&S officer to sign and issue entry permits. The current CSE Coordinators are listed in Attachment E.
Entry Supervisor	An entry team member trained and authorized to certify that entry permit conditions have been met.
Confined-Space Entrant	Entry team members who are trained to perform actual work in confined space.
Entry Attendant	A team member **outside** the confined space who monitors conditions inside and outside of the space.
Rescuers	Stand-by personnel who respond to emergencies in confined spaces.

CDM employees may fill these roles only when their operating unit s H&S manager determines that they are qualified. Team members must possess valid immunization for any disease (for example, tetanus or hepatitis) that the H&S group, with the advice of CDM's medical consultant, determines are appropriate for the space. The personnel who fill these roles must have completed the training and passed the examination required by these procedures. The division will keep a written record of the length and content of such

training.

Team members who do not work for CDM may fill the on-site roles, if they meet the requirements. A CDM construction inspector, for example, may enter a space while a general contractor s employee serves as the entry attendant, if that employee 1) has completed training equivalent to that shown in this program and 2) can fully perform the attendant's role. Only CSE coordinators may evaluate the CSE programs of other organizations.

The persons who fill the roles described above shall perform the tasks described below:

The **CSE Coordinator** shall;

- Provide advice to project personnel on the applicability of this procedure to their projects.

- Review confined space entry permits for completeness and appropriate controls. Approve (or disapprove) them in a timely manner that facilitates project work.

- Consider waiving the permit if potential entry of materials or energy represents the only reason to consider a space permit - required and the space has been completely isolated.

The **Project Manager** shall

- Evaluate every work space to determine whether it is confined.

- Contact the local coordinator to discuss the potential hazards of each confined space that CDM or subcontractor personnel will enter.

The **Entry Supervisor** shall:

- Learn about the hazards of the space, and the materials in it, and how to recognize the signs and symptoms of exposure to any toxic materials in the space.

- Assure that the pre-entry check list on the permit is complete and that conditions are acceptable before any employee enters a confined space and while the employee is in the space.

- Perform air monitoring as required by the permit.

- Verify that the rescue worker is available and establish communications for summoning him or her.

- Immediately terminate the entry when a non-permitted condition occurs.

- Sign the entry permit to authorize entry.

The Entry Supervisor may serve as an entrant or an attendant in accordance with the following requirements specified below.

The **Entry Attendant** must:

- Learn about the hazards of the space, the materials in it, and the signs and symptoms of exposure to any toxic materials in the space.
- Read and understand the permit.
- Remain outside the confined space, immediately available, and in communication with entrants (the attendant may perform tasks in addition to those listed below during entries, as long as he or she never loses track of an entrant's location and condition).
- Leave only when replaced by an equally qualified individual or to save his or her own life. If the attendant must leave and there is no replacement, order the entrants to exit the confined space.
- Stay continuously aware of the location and condition of all authorized entrants within the confined space by voice, radio, visual observation, or other equally effective means.
- Stay continuously aware of conditions in the space.
- Order entrants to exit the confined space at the first indication of hazardous condition (such as instrument alarms, visible releases, or unusual behavior by the entrants).
- Summon immediate emergency assistance, if needed.
- Warn unauthorized persons not to enter--or to exit immediately if they have already entered--and advise the authorized entrants, and management, of entry by unauthorized persons.
- Assemble and inspect the equipment that the rescue worker(s) would need to enter the space.

- Keep objects away from the access hole where they can be accidentally knocked, pushed, or dragged into the confined space. Lower tools or supplies to workers inside by a hand line.

- When the job is finished and all objects have been removed from the confined space, replace the access cover.

- Secure the safety line of any safety harnesses to a well-anchored object like an extraction tripod -- never to movable equipment or a vehicle. Monitor the safety line at all times, taking up extra slack as needed. Keep the safety line away from traffic and moving parts of any equipment.

- Test the means of non-entry retrieval. You must use a mechanical hoist, unless manual methods would be more effective.

Although low - hazard entries do not require an attendant, every employee in the space must have a buddy, who knows where they are and whether they are well. That buddy may enter the spaces or perform work that does not reduce their awareness of the employees in the space. The degree of vigilance with which the buddy must observe the exposed employee(s) is a permit condition that the space entry coordinator must review. Work teams larger than one person can provide their own buddy system protection, as long as someone is aware of how every member of the team is doing.

Confined Space Entrants must

- Learn about the hazards of the space, and the materials in it, and how to recognize the signs and symptoms of exposure to any toxic materials in the space.

- Read and understand the permit.

- Remove all jewelry before entering spaces in which the jewelry can compromise their protective clothing, catch on objects, or cause a spark.

- Leave cigarettes, lighters, and pagers outside the space.

- Avoid hand-to-mouth contact during entry.

- Inspect his/her own and each other's personal safety gear before and during the confined space entry.

- Wear or carry appropriate gas detector(s) during the entry.

- Comply with these procedures and all of the conditions of the permit.

- Follow the directions of the entry supervisor and the entry attendant.

- Leave the confined space and report to the entry attendant immediately upon detecting; any non-permitted condition, an alarm, or the effects of a chemical exposure.

- While working in a sub-surface space, avoid looking up.

Rescue Workers must

- must remain immediately available through out the entry.

- may perform other tasks during an entry **only** if those tasks do not impede response to emergencies.

When they are properly trained and close enough to provide quick response, request emergency agencies (such as industrial fire brigades) to provide stand-by rescue personnel. CSE coordinators may approve use of community rescue services in place of an on-scene rescue service for low-hazard entries.

CONFINED SPACE ENTRY PERMITS

Written entry permits are required for any entry into, or work in, confined spaces. Work teams that plan to enter a confined space must complete an entry permit form (Attachment C, CDM Confined Space Entry Permit). The permit: characterizes possible material and energy inputs to the confined space, identifies the personnel, describes the task, describes monitoring, lists required equipment, and identifies emergency contacts. Entry permits may only be issued by the CSE Coordinator. Call your operating unit s H&S manager if your local coordinator is not available. Actual entry is authorized only when the entry supervisor completes the pre-entry check list on the entry permit and signs the form at the bottom.

Most entry permits address a single work project in a single confined space, under specific conditions, for one work period not to exceed 8 hours. CSE coordinators can issue permits for tasks involving a group of spaces with common hazard potential (for example, an infiltration or inflow study on several manholes in a single branch line). CSE Coordinators may approve permits for longer periods if the personnel, tasks, and hazards are not expected to change. In either case, the Entry Supervisor still signs a copy of the permit prior to each entry (unless the coordinator authorizes another frequency).

Employees should note that the permit consists, mostly, of a shopping list on which they show the items they will use by marking Y in the boxes that represent the answers they choose. Answers you don t choose should be left blank. Where the form provides a choice (e.g. glasses or goggles) the employee should circle the one chosen. The special instructions space on the permit is used for describing; lock - out arrangements, coordination with client or contractor personnel, or the qualifications of the emergency

rescue personnel.

Employees who will enter a space which is 1) now free of hazards and 2) in which the hazards cannot change because the sources of material or energy are shut off and locked out, can meet the requirements of CDM s Confined Space Entry Procedure through completing a Low - Hazard Entry Permit (attached) and submitting it to the space entry coordinator for their operating unit. If sources of material or energy must be shut off, the form must show who will apply the controls and describe the lock - out procedures that will apply. Entry may proceed as soon as the space coordinator approves the permit (which can occur, for these low - hazard entries, by phone) and the required controls are in place.

When an entry occurs on a hazardous waste site the permit supplements, not supplants, the health and safety plan. If a team must conduct formal decontamination or monitor for a particularly complex set of air contaminants, the appropriate page from the hazardous waste health and safety plan should be completed and attached.

The permit forms are available as WordPerfect templates that many find saves time over manual completion. The computer mapping software available in many CDM offices reduces the effort in producing the hospital route map.

The CSE Coordinator must be informed of plans to perform hot work (burning, welding, or cutting) or to introduce chemicals to the space, such as cleaning solutions. The CSE Coordinator determines safety requirements based on the information he or she receives, therefore, providing complete and accurate information is essential to ensuring a complete permit and a safe entry.

When the entry is complete, the entry supervisor shall write "Canceled" across the permit and send it to the coordinator who issued it. The coordinator shall store one copy of the permit as an employee exposure record, and send another to the health and safety manager for his or her operating unit.

EQUIPMENT REQUIRED FOR CONFINED SPACE ENTRY

CDM personnel are approved to enter a confined space only with the equipment specified in the entry permit. The safety equipment listed in table 2, below, would be adequate for most foreseeable conditions.

TABLE 2 CSE EQUIPMENT REQUIREMENTS

Personal Protective Equipment:

Airline breathing mask or SCBA Respiratory Protection
Work-space lighting
Self-contained breathing unit Respiratory Protection
Steel-toe safety shoes Hard hat
Surgical PVC inner gloves Neoprene outer gloves
Chemical safety goggles Rubber overboots or hip waders
PVC rain suit Duct tape on wrist & ankle seams
Forced ventilation blower

Rescue Equipment:

Parachute-type safety harness Safety lifeline
Rescue and retrieval tripod or derrick Automatic rescue winch
First-aid kit Two-way radios
Fire extinguishers Mountain-climbing type ropes
Five-minute escape packs
Monitoring equipment as listed on the entry permit

Entry into many confined spaces with less equipment than that shown above may occur with the CSE coordinator's approval. Routine entries may be performed, for example, in regular work clothes when the coordinator has enough information about the conditions to approve their use.

Some circumstances that could change equipment needs include the following:

- When the monitoring equipment reveals no contaminants in the air and if there is no potential source of contaminants or oxygen depletion, respiratory protection is unnecessary.

- When the air and surfaces in the space are free of contaminants (not the case in sanitary sewers), protective clothing may not be needed.

- When air contaminants in the space can affect the worker by adsorption through the skin, a level "A" suit may be required. CDM teams will not normally perform Level A work.

- An SCBA (self-contained breathing apparatus), in stand-by working order, ready for use in emergencies may be required.

- Another type of retrieval device may substitute for the tripod and winch assembly.

Only explosion-safe equipment may be used in confined spaces that pose a potential flammability hazard. Temporary lighting in these spaces--whether electrically or battery operated--must be low-voltage, double-insulated, and explosion-safe. Tools used in confined spaces will be of a non-sparking type unless there is no potential for flammable vapors or gases in the space.

PREPARATION FOR ENTRY

Inspect the area near the confined space for tripping hazards, traffic patterns, and ignition sources--like lit cigarettes. Provide controls or remove the hazards. If needed, use high visibility cones and fencing, post signs and assign a team member to control the area. If working in a public roadway, physically protect the entry with a vehicle. Isolate the space as described in Section F.

Inspect the condition of the entry steps of the confined space. Don't rely on manhole rungs or permanent ladders if the space is often wet. If it appears that the steps will not support your weight or if the confined space contains no steps, then provide a ladder and approved hoist--or some other form of ready entry, exit, and fall protection. Only one person at a time may ascend or descend a ladder. Personnel should not carry tools or other objects in their hands while climbing into or out of the confined space. Raise and lower supplies with a rope.

Potential emergencies vary with the type of confined space. The rescue equipment, including extraction device and SCBA, should be inspected and tested prior to space entry. Attachment D presents an SCBA check-out procedure.

Co-workers shall inspect each other's safety equipment before entry into the confined space to determine if it is properly adjusted and in the proper position. Co-workers shall periodically check the integrity of each others protective clothing and equipment. Problems, such as a tear in the clothing, shall be immediately addressed.

MONITORING

Combination combustible gas indicators **will be used** to test the air in the confined space for the presence of combustible gases and adequate oxygen levels before entering, unless the CSE Coordinator determines that air monitoring is unnecessary. The permit must specify tests for additional dangerous contaminants--such as hydrogen sulfide--that could be present in the confined space.

Prior to entry, the Entry Supervisor **must** test the atmosphere within the confined space by the procedures described below.

- Start up, check voltage, and field-check the meters. Do this on site in a clean area, not near or in the confined space.

- Insert the probe about 12 inches into the space. If possible, check for gas in the space without opening the manhole cover or hatch. Read the meters.

- Drop the probe to the level that workers in the space will occupy; read it again.

- To the extent possible, measure gas conditions in pockets, corners, and so forth.

- Always check the low areas in the space since some gases are heavier than air (Hydrogen sulfide is heavier, methane lighter).

The air monitors must be field-checked in accordance with the instructions contained in the instrument manual. If the detector fails the prescribed field tests, it must be re-calibrated by the procedures established by the manufacturer. **No entry is permitted unless the required measurements have been collected.**

Because gases and vapors tend to vary in concentration in a confined space, the entrant closest to the suspected source must wear or carry the meter throughout the duration of the entry.

If any of these conditions pertain, the team must provide forced ventilation to eliminate the condition.

- A toxic material is present above half of its permissible exposure limit,
- Flammable gas is present above 10 percent of the lower explosive limit (LEL),
- Oxygen is below 19.5 or above 22 percent.

If any of these conditions pertain, entry into a confined space for any type of work is prohibited.

- Tests indicate the concentration of the flammable gases in the atmosphere is greater than 20% of the LEL,
- Oxygen is less than 19.5% or greater than 23.5%,
- A toxic contaminant is present in the air at or greater than it's IDLH.

The confined space shall be monitored as often as necessary to ensure the safety of employees, and whenever conditions change, such as temporary stoppage of mechanical ventilation or an increase in ambient air temperature. The required frequency of testing shall be a decision of the entry supervisor, based on the ongoing evaluation of the degree of hazard and recommendations from the CSE Coordinator. Unless the permit establishes another frequency, monitor air contaminants at least once an hour. Continuous monitoring provides the best protection.

ISOLATION

If material or energy can enter the space during entry, take necessary precautions, such as preventing accidental introduction of materials into the confined space and locking or tagging out energy sources.

Before employee(s) enter a confined space, the space shall be isolated to preclude the entry of materials and energy by one or more of the following methods:

1. Remove a valve or connection in the piping and cap the open end of the piping leading to the confined space. Do this as close to the space as possible.

2. Install a full-pressure blank in lines with flanged connections as close to the space as possible.

3. Close, lock and tag at least two valves in the piping leading to the confined space. Lock or tag **open** a drain valve to the atmosphere and check it to ensure it is not plugged.

4. De-energize, lock, and tag machinery, pumps, mixers, or other equipment with moving parts or conductors in the confined space.

5. Lock the gates to any dump-chute or loading port that connects with the space, or station a person at the port throughout the duration of the entry.

All employees working in the confined space shall be informed of the means by which the space was isolated. All blanks or caps shall be made of a material compatible with the liquid, vapor, or gas with which it may contact. If potential entry of materials or energy represents the only reason to consider a space permit - required, the coordinator may

waive the need for a permit after the space is completely isolated.

Sometimes CDM employees will enter a space through which flow can not be stopped (e.g. some municipal sewers). In these cases, the procedures documented in the permit must provide equivalent protection.

VENTILATION

When monitoring indicates a need for ventilation, provide an air inflow until acceptable air levels are achieved. Provide local exhaust or continuous general ventilation when the work itself (for example, welding or painting with solvent-based paint) generates a toxic atmosphere. Blowers should be coupled with large-diameter flexible hose that can direct air into the work area.

The blowers used must meet both the explosion-safety and wiring requirements of the National Electrical Code. They shall provide enough air flow to keep contaminant concentrations below 10% of the lower explosive limit and below OSHA's permissible exposure levels.

Gasoline, diesel, or gas-operated equipment used near confined spaces must be oriented so that their exhaust cannot enter the confined space. Exhausted air from the space must be directed away from the work area to an area where it presents no hazard.

Ventilation shall continue until acceptable air levels are achieved. Continuing ventilation may be required during entry. All ventilation equipment shall be located upwind to ensure fresh air intake and to ensure that contaminated air does not reach the blower, a potential source of ignition.

RESCUE PROCEDURES

Upon detecting an emergency condition, personnel in the confined space must adhere to the following procedures:

- Immediately inform the attendant of the nature of the hazard.

- Exit the space. Assist incapacitated coworkers toward the exit.

- Take no action for which you are not properly trained and equipped. Do not move coworkers who have suffered or potentially suffered spinal injury and if in no other danger from the confined space. Only doctors and paramedics may treat spinal injuries.

Upon detecting an emergency, the entry attendant must:

- Notify the rescue worker(s).
- Remain outside the confined space to lower necessary rescue equipment into the space and render other necessary assistance.
- Withdraw the worker(s) with the safety line.
- Notify the emergency-service providers specified in the permit. Give the location of the emergency and any other pertinent information and guide emergency units to the scene.

Upon detecting an emergency, rescue workers must

- Report to the confined space as quickly as possible.
- If appropriate, don an SCBA.
- Enter, if safe, to offer assistance and to correct the problem.

Protection of employee life and health is the first priority of the rescue worker. No employee may enter the confined space without an SCBA until all causes of the incapacitation have been eliminated. Rescue workers require protective clothing as resistant as that of the entrants unless otherwise specified in the permit.

The rescue team must be trained in

- The requirements for entrants.
- Rescue functions using the retrieval and rescue equipment used. NOTE: Rescuers must rehearse these rescue techniques at least once per year.
- Basic first-aid and cardiopulmonary resuscitation. NOTE: At least one rescuer must possess a valid first-aid and CPR certification, the entry may not proceed.

REFERENCES

A. OSHA Standard 29 CFR 1910.146, Permit-Required Confined Spaces, January 14, 1993

B. NIOSH Criteria Document, Working in Confined Spaces, December, 1979.

ATTACHMENTS

Attachment A - CDM Confined Space Entry Training Course Example

Attachment B - CDM Confined Space Entry Permit

Attachment C - MSA 401 Ultralite II SCBA Check-Out Procedure

Attachment D - CDM Confined Space Entry Coordinators

Attachment E - CDM Low - Hazard Space Entry Permit

CDM CONFINED SPACE ENTRY TRAINING COURSE EXAMPLE

Time	Topic	Format
8:00 - 8:20	Introductions	
8:20 - 8:45	Basic Confined Space Issues	Video
	(Locations, Hazards, Permits, Un-permitted Entry)	
8:45 - 9:30	CDM Confined Space Procedure	Lecture
9:30 - 9:40	Break	
9:40 - 10:05	CDM Hazard Communication	Video
10:05 - 10:30	Subcontractors and Confined Spaces	Lecture
10:30 - 10:50	Personal Protective Equipment	Demonstration
	(Protective Clothing, Respirators)	
10:50 - 11:00	Break	
11:00 - 11:20	Use and Maintenance of the Ultratwin APR	Video
11:20 - 11:40	Air - Purifying Respirators Workshop	Exercise
11:40 - 12:00	Traffic safety	Video
12:00 - 12:30	Lunch	
12:30 - 12:40	Principles of Lockout and Tag-out	Video
12:40 - 1:00	Exposure Monitoring Workshop	Demonstration
	(Toxics, Flammables, H_2S, Oxygen, Odor, Illness)	
1:00 - 1:10	Response to Emergency Conditions	Video
1:10 - 1:40	Emergency Preparedness & Response	Lecture
1:40 - 1:50	Break	
1:50 - 2:15	Emergency Rescue Workshop	Discussion
2:15 - 2:30	Confined Space Ventilation	Video
2:30 - 2:55	Permit Procedure Workshop	Exercise
2:55 - 3:05	Harnesses, Tripods and Winches	Exercise
3:05 - 3:25	Shipping of Hazardous Materials	Video

CDM Confined Space Entry Permit Attachment B

Project or Contract: _____

Space to be Entered: _____

Section drawing showing material and energy inputs attached? YES or NO

Nature of Task: _____

Hot Work? _____

Is there a potential for:

Physical Injury? _____ Vehicular Traffic? _____ Toxic Gases or Vapors? _____

Explosive Gases? _____ Oxygen Deficiency? _____ Exposure to Microbes? _____

Heat Stress? _____ Cold Stress? _____ Engulfment? _____

Duration of Permit: From: _____ To: _____

Entry Supervisor _____

Authorized Entrants: _____

Rescuers: _____

Attendants: _____

Means of Communication with Entrants: _____

_____

Safety Equipment Outside the Space:

Needed?	In Place?	(To Be Initialed By Entry Supervisor)
		Traffic cones or barriers in place
		Ventilation system in operation
		Rescue and retrieval equipment in place.
		SCBA inspected and ready (topside) for emergency use.
		Valves locked out or made inoperable (N/A if not applicable).
		Electrical equipment disconnected & locked out (or N/A).
		Pneumatic & hydraulic equipment disconnected & locked out (or N/A).
YES	_____	Rescue service is currently available.
		Radio, phone, or portable phone reaches rescue team
		Ignition sources eliminated/isolated.

Safety Equipment in the Space :

Needed?	In Place?		Needed?	In Place?	
		SCBA or Airline respirator	_____	_____	5-min. escape pack
		Air filtering respirator	_____	_____	Ladder for entry
		Steel-toe safety shoes	_____	_____	Rubber overboots
		Surgical inner gloves	_____	_____	Rubber outer gloves
		Leather or cloth gloves	_____	_____	Cloth coveralls
		Tyvek or Saranex coveralls	_____	_____	PVC rain suit
		Safety goggles or glasses	_____	_____	Face shield
		Safety harness & lifeline	_____	_____	Hard hat
		Fire extinguisher (topside)	_____	_____	Flashlight or lamp

Atmospheric Testing and Conditioning:

Calibrate instruments per manufacturer's instructions. Measure gases just inside the space and at locations workers will occupy.

Needed?		Readings			
N/A	Time of Day				
	Oxygen deficiency (>19.5% and <21.5%).				
	Flammable gases (Less than 10% LEL).				
	Toxics (<PEL). Specify:_____				
Yes	Initials of Attendant				

Emergency Service	Provider	Telephone Number
CDM 24 hour Emergency	CDM CHSO	800 / 313 - 5593
Health and Safety Manager		
Project Manager		
Space Entry Coordinator		
Client Contact		
Fire Department		
Police Department		
Health Department		
Poison Control Center		
Hospital address		
Contact at hospital		
24-hour ambulance		

Route to Hospital (instructions or map):

Special Instructions:

PERMIT APPROVED: _____ _____
Confined-Space-Entry Coordinator Date

ENTRY APPROVED: _____ _____
Entry Supervisor Date

Attachment C

MSA 401--ULTRALITE II SCBA CHECK-OUT PROCEDURE

Monthly Inspection:

1. Check the cylinder label for a current hydrostatic test date.
2. Inspect the cylinder for large dents or gouges.
3. Inspect the cylinder gauge for damage.
4. Complete a routine inspection.
5. Fill out the appropriate records with results and recommendations.

Routine Inspection: Perform immediately before donning and after cleaning.

1. Before proceeding, check that the
- o O-ring is present on the conical high-pressure fitting.
- o Bypass valve is closed.
- o Mainline valve is closed.
- o Regulator outlet is not covered or obstructed.

2. Backpack and harness assembly:
- o Visually inspect straps for wear, damage, and completeness.
- o Check the wear and function of the belt.
- o Check the back-plate and the cylinder holder for damage.
- o Check that the cylinder is firmly attached to the back-plate.

3. Cylinder and high pressure hose assembly:
- o Attach the high-pressure hose connector to the cylinder fitting.
- o Check that the belt and the high-pressure hose are not tangled.
- o Open the cylinder valve and listen or feel for any leakage around the packing and the hose connection.
- o Check the high pressure hose for damage or leaks.

4. Regulator Function:
- o Cover the regulator outlet with the palm of your hand.
- o Open the round golden mainline valve.
- o Note the stoppage of air flow after the positive pressure has built up.
- o Compare the pressure reading on the cylinder and regulator gauges; they should be the same.
- o Close the mainline valve.
- o Remove hand from the regulator outlet.
- o Open the magenta bypass valve slowly. Note its function.
- o Close the bypass valve.

Attachment C

MSA 401--ULTRALITE II SCBA CHECK-OUT PROCEDURE

5. Warning Alarm and Regulator Integrity:
- Cover the regulator outlet again with the heel of your hand.
- Open the mainline valve.
- While covering the regulator outlet, close the cylinder valve.
- Move your hand from the outlet so the air drains out slowly.
- Observe the regulator gauge reading at which the low-pressure alarm sounds. It should start sounding at 550 to 650 pounds per square inch (psi).
- Remove your hand from the regulator outlet.
- Close the mainline valve.
- Blow air into the regulator for 5 to 10 seconds.
- Draw air from the outlet for 5 to 10 seconds.
- If a positive pressure or vacuum cannot be maintained, there is a leak. **DO NOT USE THE SCBA!**

6. Face piece and corrugated breathing hose:
- Inspect the head harness and the Face piece for damage, serrations, and deteriorated rubber.
- Inspect the lens for damage and proper seal in the Face piece. Inspect the exhalation valve for damage and dirt build-up.
- With the breathing hose separated from the Face piece, inspect the hose connector for damage and presence of a wagon-wheel washer.
- Stretch the breathing hose, and carefully inspect it for holes and deterioration.
- Attach the breathing hose to the Face piece.
- Perform a negative-pressure test with the Face piece donned.

7. Storage:
- Refill the cylinder to 2,216 psi.
- Close the cylinder valve.
- Tightly connect the high-pressure hose to the cylinder.
- Bleed the pressure from the high-pressure hose by opening mainline valve.
- Close the mainline valve.
- Close the bypass valve.
- Fully extend all of the straps.
- Store the Face piece in a clean plastic bag for protection.

CONFINED SPACE ENTRY COORDINATORS

As of April 28, 1998, the persons listed below were authorized to approve permits for confined space entries by CDM employees. These coordinators are listed with their home offices to facilitate contact.

-Pat Dentler	CDM - Albuquerque, NM
-Tim Grant	CDM - Raleigh, NC
-Steve Hoffman	CDM - Orlando, FL
-Michael Leroux	CDM - Cambridge, MA
-Chris Marlowe	CDM - Edison, NJ
-Mark Mihm	CDM - Dallas, TX
-Chuck Myers	FPC - Fairfax, VA
-Rick Shelton	CDM - Sarasota, FL
-Ken Page	OOCH - Cambridge, MA

Attachment E
CDM LOW - HAZARD SPACE ENTRY PERMIT

Project or Contract: _____
Space to be Entered: _____
Material and Energy Inventory (Section Diagram) Attached? YES or NO
Nature of Task: _____
_____

Potential for:
Physical Injury? _____ Vehicular Traffic? _____
Explosive Gases? _____ Toxic Gases or Vapors? _____
Oxygen Deficiency? _____ Exposure to Microbes? _____
Heat Stress? _____ Cold Stress? _____

Entry Supervisor _____
Authorized Entrants: _____
Rescuers: _____
Buddy: _____
Means of Communication with Entrants _____
_____

Pre-Entry Check List:

Material (Flow) Sources to control — Procedure for Control and Lock - out
_____
_____
_____
_____

Energy Sources to control — Procedure for Control and Lock - out
_____
_____
_____
_____

Needed?	In Place?	(To Be Initialed By Entry Supervisor)
		Traffic cones or barriers in place
		Entrants wearing safety harnesses.
Yes	_____	Rescue service is currently available.

_____

Personal Protective Equipment for Entrants:

Needed?	In Place?		Needed?	In Place?	
		Ventilation system	_____	_____	Steel-toe safety shoes
		Rubber overboots	_____	_____	Surgical inner gloves
		Rubber outer gloves	_____	_____	Leather or cloth gloves
		Cloth coveralls	_____	_____	PVC rain suit
		Safety goggles or glasses	_____	_____	Radio or portable phone
		Hard hat	_____	_____	Work space lighting

Emergency Service	Provider	Telephone Number

Attachment E
CDM LOW - HAZARD SPACE ENTRY PERMIT

CDM 24 hour Emergency	CDM CHSO	800 / 313 - 5593
Health and Safety Manager		
Project Manager		
Space Entry Coordinator		
Client Contact		
Fire Department		
Police Department		
Health Department		
Poison Control Center		
Hospital address		
Contact at hospital		
24-hour ambulance		

Route to Hospital (instructions or map):

Special Instructions:

PERMIT APPROVED: _____ _____
Confined-Space-Entry Coordinator Date

ENTRY APPROVED: _____ _____
Entry Supervisor Date

Appendix B

EQUIPMENT AND BOTTLE CLEANING PROTOCOLS

BOTTLE AND EQUIPMENT CLEANING PROCEDURES

Composite Bottles (carboys)

1. Rinse bottle with warm tap water three times as soon as possible after emptying sample.
2. Soak in a 2% Contrad solution for 48 hours; scrub with clean plastic brush.
3. Rinse three times with tap water.
4. Rinse five times with Milli-Q water, rotating the bottle to ensure contact with the entire inside surface.
5. Rinse three times with hexane, rotating the bottle to ensure contact with the entire inside surface (use 30 ml per rinse).
6. Rinse six times with Milli-Q water.
7. Rinse three times with 2N nitric acid (1 liter per bottle, per rinse) rotating the bottle to ensure contact with the entire inside surface.
8. Rinse six times with Milli-Q water.
9. Cap bottle with Teflon lined lid cleaned as specified below.

Teflon Tubing, Lids and Strainers

1. Make up a 2% solution of Micro soap in warm tap water.
2. Rinse tubing three times with the 2% Micro Solution, wash lids and strainers with micro solution and plastic brush.
3. Rinse three times with tap water.
4. Rinse three times with Milli-Q water.
5. Rinse three times with a 2N nitric acid solution.
6. Soak 24 hours in a 2N nitric acid solution.
7. Rinse three times with Milli-Q water.
8. Seal the tubing on both ends with clean latex material
9. Individually Double-bag tubing in new polyethylene bags properly labeled. Double-bag lids and strainers individually in zip-lock bags.

Cleaning Solutions

2% Contrad = 200 ml concentrated Contrad per full 10L bottle

2% HNO_3 Acid = 80 ml concentrated HNO_3 acid (16N) per gallon of Milli-Q water

2% Micro = 80 ml concentrated Micro per gallon of Milli-Q water

Equipment and Handling

1. Safety Precautions - All of the appropriate safety equipment must be worn by personnel involved in the cleaning of the bottles due to the corrosive nature of the chemicals being used to clean the bottles and tubing. This safety equipment must include protective gloves, lab coats, chemically resistant aprons, goggles with side shields and respirators. All MSDS must be read and signed off by personnel.

2. A record book must be kept of each sample bottle washed, outlining the day the bottle was cleaned and checked off for passage of the quality control check.

3. Nitrile gloves must be worn while cleaning and handling bottles and equipment. Care must be taken at all times to avoid introduction of contamination from any source.

Appendix C

FIELD FORMS

CALTRANS TAHOE BASIN SITE VISIT LOG - SITE LOCATION/NO.#________________________

DATE and TIME	NAME	PURPOSE OF VISIT	LEVEL (cm.)	FLOW	TOTAL (X10) (ltrs.)	VELOCITY (ltr/sec.)	RAIN (cm.)	VOLTS	COMMENTS

FLOW METER AND AUTOSAMPLER PROGRAM SHEETS

FLOW METER SET-UP PROGRAMMING
TAHOE MEADOWS SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Set-up Menu: ***Modify All Items***

1. Select Flow Units	*liters per second (l/s)*		
2. Select Level Unit of Measure	*centimeters (cm)*		
3. Select Primary Device	*area velocity*		
4. Method of Calculating Area	*geometry*		
5. Shape	*circular pipe*		
6. Pipe Diameter	*18 in.*		
7. Program Lock	*disabled*		
7. Sampler Pacing	*enabled*		
8. Flow Interval (i.e. trigger volume)	*get from SEC*		
9. Enter Site ID	*3201*		
10..Enter Total Flow Units	*liters (l)*		
11..Enter Velocity Direction	*upstream (normal)*		
12. Enter Velocity Units	*meters per second (m/s)*		
13. Enter Velocity Cutoff	*0.0*	Default Value	*0.0*

Options Menu:

1. Set Time & Date	*check*
2. Advanced Options	*select*

Advanced Options Menu:

1. Alarms		*none*					
2. Calibration		*bubbler rate*					
3. Communication Set-up							
Modem Set-up							
Modem Power		*enabled*					
Dial Method		*tone*					
Phone Number		*N/A*					
Cellular Modem Setting		*disabled*					
Pager Option		*N/A*					
Baud Rate		*N/A*					
RS-232 Set-up							
RS-232 Baud		*19200*					
4. Data Log							
Select Inputs							
Rainfall	Logged	*yes*	Logging Interval	*5 min.*	Units	*cm.*	
Level/Flow	Logged	*yes*	Logging Interval	*1 min*	Units	*cm.*	
Velocity	Logged	*yes*	Logging Interval	*1 min*	Units	*m/s*	
5. Extended Power Mode		*disabled*	Logging Intervals for all Channels			*5 min.*	
6. Memory Mode		*wrap*					
7. Flow Totalizer Scaling		*X10*	Flow Units	*liters*			

AUTOSAMPLER SET-UP PROGRAMMING
TAHOE MEADOWS SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Prior to programming, set the sampler with the correct time and date making sure the sampler and flow meter are synchronized.

1. To check time and date, press the **"TIME READ"** key
2. To change the time or date, press the **"TIME SET"** key

Press the **"ASTERICK" (*)** key to access programming

***1. Alter parameters?	*no*
2. Enable advanced program	*yes*
3. Enter number of sample bottles	*1*
4. Enter units for bottle volume	*ml*
5. Enter bottle volume	*10000*
6. Enter units for tubing length	*ft.*
7. Enter length of tubing	*30*

Verify program

8. Program lock?	*no*
9. Variable interval?	*don't touch*
10. pH/ORP?	*no*
11. Program delay?	*no*
12. Flow mode?	yes
13. Variable interval?	no
14. Interval counts?	*1*
15. Timed override?	*no*
16. Continuous mode?	*yes*
17. Change volume?	*yes*
18. Sample volume?	*250 ml.*
**19. Calibrate volume?	*yes*
**20. Auto calibrate?	*yes*
**21. Ready to pump?	*yes*
22. Enter actual volume pumped	_____
23. Intake rinses?	*yes*
24. Rinse cycles?	*1*
25. Intake faults?	*no*
26. Enter ID#	*3-201*

(*) Answer yes if you wish to change the current program.
(**) Answer no if you do not wish to calibrate sample volume.

FLOW METER SET-UP PROGRAMMING
TAHOE AIRPORT SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Set-up Menu: ***Modify All Items***

1. Select Flow Units	*liters per second (l/s)*			
2. Select Level Unit of Measure	*centimeters (cm)*			
3. Select Primary Device	*weir*			
4. Weir type	*noncontinuous rectangular*			
5. Width	*21.94 in.*			
6. Program Lock	*disabled*			
7. Sampler Pacing	*enabled*			
8. Flow Interval (i.e. trigger volume)	*get from SEC*			
9. Enter Site ID	*3202*			
10..Enter Total Flow Units	*liters (l)*			
11..Enter Velocity Direction	*upstream (normal)*			
12. Enter Velocity Units	*meters per second (m/s)*			
13. Enter Velocity Cutoff	*0.0*	Default Value	*0.0*	

Options Menu:

1. Set Time & Date	*check*
2. Advanced Options	*select*

Advanced Options Menu:

1. Alarms	*none*					
2. Calibration	*bubbler rate*					
3. Communication Set-up						
Modem Set-up						
Modem Power	*enabled*					
Dial Method	*tone*					
Phone Number	*N/A*					
Cellular Modem Setting	*disabled*					
Pager Option	*N/A*					
Baud Rate	*N/A*					
RS-232 Set-up						
RS-232 Baud	*19200*					
4. Data Log						
Select Inputs						
Rainfall	Logged	*yes*	Logging Interval	*5 min.*	Units	*cm.*
Level/Flow	Logged	*yes*	Logging Interval	*1 min*	Units	*cm.*
Velocity	Logged	*N/A*	Logging Interval	*N/A*	Units	*N/A*
5. Extended Power Mode		*disabled*	Logging Intervals for all Channels			*5 min.*
6. Memory Mode		*wrap*				
7. Flow Totalizer Scaling		*X10*	Flow Units	*liters*		

Level Adjust Setting (Measured) -41.593 cm

AUTOSAMPLER SET-UP PROGRAMMING
TAHOE AIRPORT SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Prior to programming, set the sampler with the correct time and date making sure the sampler and flow meter are synchronized.

1. To check time and date, press the **"TIME READ"** key
2. To change the time or date, press the **"TIME SET"** key

Press the **"ASTERICK" (*)** key to access programming

	INFLUENT SAMPLER	EFFLUENT SAMPLER
***** 1. Alter parameters?	*no*	*no*
2. Enable advanced program	*yes*	*yes*
3. Enter number of sample bottles	*1*	*1*
4. Enter units for bottle volume	*ml*	*ml*
5. Enter bottle volume	*10000*	*10000*
6. Enter units for tubing length	*ft.*	*ft.*
7. Enter length of tubing	*16*	*13*
Verify program		
8. Program lock?	*no*	*no*
9. Variable interval?	*don't touch*	*don't touch*
10. pH/ORP?	*no*	*no*
11. Program delay?	*no*	*no*
12. Flow mode?	yes	*yes*
13. Variable interval?	no	no
14. Interval counts?	*1*	*1*
15. Timed override?	*no*	*no*
16. Continuous mode?	*yes*	yes
17. Change volume?	*yes*	*yes*
18. Sample volume?	*250 ml.*	*250 ml.*
** 19. Calibrate volume?	*yes*	*yes*
** 20. Auto calibrate?	*yes*	*yes*
** 21. Ready to pump?	*yes*	*yes*
22. Enter actual volume pumped	_____	_____
23. Intake rinses?	*yes*	*yes*
24. Rinse cycles?	*1*	*1*
25. Intake faults?	*no*	*no*
26. Enter ID#	*3-202*	*3-222*

(*) Answer yes if you wish to change the current program.
(**) Answer no if you do not wish to calibrate sample volume.

FLOW METER SET-UP PROGRAMMING
ECHO SUMMIT SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Set-up Menu: ***Modify All Items***

1. Select Flow Units	*liters per second (l/s)*			
2. Select Level Unit of Measure	*centimeters (cm)*			
3. Select Primary Device	*weir*			
4. Weir type	*noncontinuous rectangular*			
5. Width	*21.85 in.*			
6. Program Lock	*disabled*			
7. Sampler Pacing	*enabled*			
8. Flow Interval (i.e. trigger volume)	*get from SEC*			
9. Enter Site ID	*3203*			
10..Enter Total Flow Units	*liters (l)*			
11..Enter Velocity Direction	*upstream (normal)*			
12. Enter Velocity Units	*meters per second (m/s)*			
13. Enter Velocity Cutoff	*0.0*	Default Value	*0.0*	

Options Menu:

1. Set Time & Date	*check*
2. Advanced Options	*select*

Advanced Options Menu:

1. Alarms	*none*					
2. Calibration	*bubbler rate*					
3. Communication Set-up						
Modem Set-up						
Modem Power	*enabled*					
Dial Method	*tone*					
Phone Number	*N/A*					
Cellular Modem Setting	*disabled*					
Pager Option	*N/A*					
Baud Rate	*N/A*					
RS-232 Set-up						
RS-232 Baud	*19200*					
4. Data Log						
Select Inputs						
Rainfall	Logged	*yes*	Logging Interval	*5 min.*	Units	*cm.*
Level/Flow	Logged	*yes*	Logging Interval	*1 min*	Units	*cm.*
Velocity	Logged	*N/A*	Logging Interval	*N/A*	Units	*N/A*
5. Extended Power Mode		*disabled*	Logging Intervals for all Channels			*5 min.*
6. Memory Mode		*wrap*				
7. Flow Totalizer Scaling		*X10*	Flow Units	*liters*		

Level Adjust Setting (Measured) -47.308 (cm)

AUTOSAMPLER SET-UP PROGRAMMING
ECHO SUMMIT SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Prior to programming, set the sampler with the correct time and date making sure the sampler and flow meter are synchronized.

1. To check time and date, press the **"TIME READ"** key
2. To change the time or date, press the **"TIME SET"** key

Press the **"ASTERICK" (*)** key to access programming

	INFLUENT SAMPLER	EFFLUENT SAMPLER
***** 1. Alter parameters?	*no*	*no*
2. Enable advanced program	*yes*	*yes*
3. Enter number of sample bottles	*1*	*1*
4. Enter units for bottle volume	*ml*	*ml*
5. Enter bottle volume	*10000*	*10000*
6. Enter units for tubing length	*ft.*	*ft.*
7. Enter length of tubing	*20*	*15*
Verify program		
8. Program lock?	*no*	*no*
9. Variable interval?	*don't touch*	*don't touch*
10. pH/ORP?	*no*	*no*
11. Program delay?	*no*	*no*
12. Flow mode?	yes	*yes*
13. Variable interval?	no	no
14. Interval counts?	*1*	*1*
15. Timed override?	*no*	*no*
16. Continuous mode?	*yes*	*yes*
17. Change volume?	*yes*	*yes*
18. Sample volume?	*250 ml.*	*250 ml.*
** 19. Calibrate volume?	*yes*	*yes*
** 20. Auto calibrate?	*yes*	*yes*
** 21. Ready to pump?	*yes*	*yes*
22. Enter actual volume pumped	_____	_____
23. Intake rinses?	*yes*	*yes*
24. Rinse cycles?	*1*	*1*
25. Intake faults?	*no*	*no*
26. Enter ID#	*3-203*	*3-223*

(*) Answer yes if you wish to change the current program.
(**) Answer no if you do not wish to calibrate sample volume.

FLOW METER SET-UP PROGRAMMING
D.L. BLISS SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Set-up Menu: ***Modify All Items***

1. Select Flow Units	*liters per second (l/s)*			
2. Select Level Unit of Measure	*centimeters (cm.)*			
3. Select Primary Device	*weir*			
4. Weir type	*noncontinuous rectangular*			
5. Width	*21.75 in.*			
6. Program Lock	*disabled*			
7. Sampler Pacing	*enabled*			
8. Flow Interval (i.e. trigger volume)	*get from SEC*			
9. Enter Site ID	*3218*			
10..Enter Total Flow Units	*liters (l)*			
11..Enter Velocity Direction	*upstream (normal)*			
12. Enter Velocity Units	*meters per second (m/s)*			
13. Enter Velocity Cutoff	*0.0*	Default Value	*0.0*	

Options Menu:

1. Set Time & Date	*check*
2. Advanced Options	*select*

Advanced Options Menu:

1. Alarms	*none*					
2. Calibration	*bubbler rate (1)*					
3. Communication Set-up						
Modem Set-up						
Modem Power	*enabled*					
Dial Method	*tone*					
Phone Number	*N/A*					
Cellular Modem Setting	*disabled*					
Pager Option	*N/A*					
Baud Rate	*N/A*					
RS-232 Set-up						
RS-232 Baud	*19200*					
4. Data Log						
Select Inputs						
Rainfall	Logged	*yes*	Logging Interval	*5 min.*	Units	*cm.*
Level/Flow	Logged	*yes*	Logging Interval	*1 min*	Units	*cm.*
Velocity	Logged	*N/A*	Logging Interval	*N/A*	Units	*N/A*
5. Extended Power Mode		*disabled*	Logging Intervals for all Channels			*5 min.*
6. Memory Mode		*wrap*				
7. Flow Totalizer Scaling		X10	low Units	*liters*		

Level Adjust Setting (Measured) -50.800 (cm)

AUTOSAMPLER SET-UP PROGRAMMING
D. L. BLISS SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Prior to programming, set the sampler with the correct time and date making sure the sampler and flow meter are synchronized.

1. To check time and date, press the **"TIME READ"** key
2. To change the time or date, press the **"TIME SET"** key

Press the **"ASTERICK" (*)** key to access programming

	INFLUENT SAMPLER
***1. Alter parameters?	*no*
2. Enable advanced program	*yes*
3. Enter number of sample bottles	*1*
4. Enter units for bottle volume	*ml*
5. Enter bottle volume	*10000*
6. Enter units for tubing length	*ft.*
7. Enter length of tubing	*13*
Verify program	
8. Program lock?	*no*
9. Variable interval?	*don't touch*
10. pH/ORP?	*no*
11. Program delay?	*no*
12. Flow mode?	yes
13. Variable interval?	no
14. Interval counts?	*1*
15. Timed override?	*no*
16. Continuous mode?	*yes*
17. Change volume?	*yes*
18. Sample volume?	*250 ml.*
**19. Calibrate volume?	*yes*
**20. Auto calibrate?	*yes*
**21. Ready to pump?	*yes*
22. Enter actual volume pumped	_____
23. Intake rinses?	*yes*
24. Rinse cycles?	*1*
25. Intake faults?	*no*
26. Enter ID#	*3-218*

(*) Answer yes if you wish to change the current program.
(**) Answer no if you do not wish to calibrate sample volume.

FLOW METER SET-UP PROGRAMMING
SNOW CREEK SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Set-up Menu: ***Modify All Items***

1. Select Flow Units	*liters per second (l/s)*		
2. Select Level Unit of Measure	*centimeters (cm)*		
3. Select Primary Device	*area velocity*		
4. Method of Calculating Area	*geometry*		
5. Shape	*circular pipe*		
6. Pipe Diameter	*18 in.*		
7. Program Lock	*disabled*		
7. Sampler Pacing	*enabled*		
8. Flow Interval (i.e. trigger volume)	*get from SEC*		
9. Enter Site ID	*3219*		
10..Enter Total Flow Units	*liters (l)*		
11..Enter Velocity Direction	*upstream (normal)*		
12. Enter Velocity Units	*meters per second (m/s)*		
13. Enter Velocity Cutoff	*0.0*	Default Value	*0.0*

Options Menu:

1. Set Time & Date	*check*
2. Advanced Options	*select*

Advanced Options Menu:

1. Alarms		*none*					
2. Calibration		*bubbler rate (1)*					
3. Communication Set-up							
Modem Set-up							
Modem Power		dis*abled*					
Dial Method		*tone*					
Phone Number		*N/A*					
Cellular Modem Setting		*disabled*					
Pager Option		*N/A*					
Baud Rate		*N/A*					
RS-232 Set-up							
RS-232 Baud		*19200*					
4. Data Log							
Select Inputs							
Rainfall	Logged	*yes*	Logging Interval	*5 min.*	Units	*cm.*	
Level/Flow	Logged	*yes*	Logging Interval	*1 min*	Units	*cm.*	
Velocity	Logged	*yes*	Logging Interval	*1 min*	Units	*m/s*	
5. Extended Power Mode		*disabled*	Logging Intervals for all Channels			*5 min.*	
6. Memory Mode		*wrap*					
7. Flow Totalizer Scaling		*X10*	Flow Units	*liters*			

AUTOSAMPLER SET-UP PROGRAMMING
SNOW CREEK SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Prior to programming, set the sampler with the correct time and date making sure the sampler and flow meter are synchronized.

1. To check time and date, press the **"TIME READ"** key
2. To change the time or date, press the **"TIME SET"** key

Press the **"ASTERICK" (*)** key to access programming

***1. Alter parameters?	*no*
2. Enable advanced program	*yes*
3. Enter number of sample bottles	*1*
4. Enter units for bottle volume	*ml*
5. Enter bottle volume	*10000*
6. Enter units for tubing length	*ft.*
7. Enter length of tubing	15

Verify program

8. Program lock?	*no*
9. Variable interval?	*don't touch*
10. pH/ORP?	*no*
11. Program delay?	*no*
12. Flow mode?	yes
13. Variable interval?	no
14. Interval counts?	*1*
15. Timed override?	*no*
16. Continuous mode?	*yes*
17. Change volume?	*yes*
18. Sample volume?	*250 ml.*
**19. Calibrate volume?	*yes*
**20. Auto calibrate?	*yes*
**21. Ready to pump?	*yes*
22. Enter actual volume pumped	_____
23. Intake rinses?	*yes*
24. Rinse cycles?	*1*
25. Intake faults?	*no*
26. Enter ID#	*3-219*

(*) Answer yes if you wish to change the current program.
(**) Answer no if you do not wish to calibrate sample volume.

FLOW METER SET-UP PROGRAMMING
BROCKWAY SUMMIT SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Set-up Menu: ***Modify All Items***

1. Select Flow Units	*liters per second (l/s)*		
2. Select Level Unit of Measure	*centimeters (cm)*		
3. Select Primary Device	*area velocity*		
4. Method of Calculating Area	*geometry*		
5. Shape	*circular pipe*		
6. Pipe Diameter	*18 in.*		
7. Program Lock	*disabled*		
7. Sampler Pacing	*enabled*		
8. Flow Interval (i.e. trigger volume)	*get from SEC*		
9. Enter Site ID	*3220*		
10..Enter Total Flow Units	*liters (l)*		
11..Enter Velocity Direction	*upstream (normal)*		
12. Enter Velocity Units	*meters per second (m/s)*		
13. Enter Velocity Cutoff	*0.0*	Default Value	*0.0*

Options Menu:

1. Set Time & Date	*check*
2. Advanced Options	*select*

Advanced Options Menu:

1. Alarms		*none*					
2. Calibration		*bubbler rate*					
3. Communication Set-up							
Modem Set-up							
Modem Power		dis*abled*					
Dial Method		*tone*					
Phone Number		*N/A*					
Cellular Modem Setting		*disabled*					
Pager Option		*N/A*					
Baud Rate		*N/A*					
RS-232 Set-up							
RS-232 Baud		*19200*					
4. Data Log							
Select Inputs							
Rainfall	Logged	*yes*	Logging Interval	*5 min.*	Units	*cm.*	
Level/Flow	Logged	*yes*	Logging Interval	*1 min*	Units	*cm.*	
Velocity	Logged	*yes*	Logging Interval	*1 min*	Units	*m/s*	
5. Extended Power Mode		*disabled*	Logging Intervals for all Channels			*5 min.*	
6. Memory Mode		*wrap*					
7. Flow Totalizer Scaling		*X10*	Flow Units	*liters*			

AUTOSAMPLER SET-UP PROGRAMMING
BROCKWAY SUMMIT SITE

Caltrans Tahoe Basin Stormwater Monitoring and Sediment Trap Effectiveness Program

Prior to programming, set the sampler with the correct time and date making sure the sampler and flow meter are synchronized.

1. To check time and date, press the **"TIME READ"** key
2. To change the time or date, press the **"TIME SET"** key

Press the **"ASTERICK" (*)** key to access programming

***1. Alter parameters?	*no*
2. Enable advanced program	*yes*
3. Enter number of sample bottles	*1*
4. Enter units for bottle volume	*ml*
5. Enter bottle volume	*10000*
6. Enter units for tubing length	*ft.*
7. Enter length of tubing	*30*

Verify program

8. Program lock?	*no*
9. Variable interval?	*don't touch*
10. pH/ORP?	*no*
11. Program delay?	*no*
12. Flow mode?	yes
13. Variable interval?	no
14. Interval counts?	*1*
15. Timed override?	*no*
16. Continuous mode?	*yes*
17. Change volume?	*yes*
18. Sample volume?	*250 ml.*
**19. Calibrate volume?	*yes*
**20. Auto calibrate?	*yes*
**21. Ready to pump?	*yes*
22. Enter actual volume pumped	_____
23. Intake rinses?	*yes*
24. Rinse cycles?	*1*
25. Intake faults?	*no*
26. Enter ID#	*3-220*

(*) Answer yes if you wish to change the current program.
(**) Answer no if you do not wish to calibrate sample volume.

SEDIMENT TRAP EFFECTIVENESS STUDY FORMS

STATION VISIT CHECKLIST FOR SETUP/BOTTLE REPLACEMENT/SHUT-DOWN
Treatment Effectiveness Study

Set-Up Crew Name: _____ Date & Time of Set-Up: _____
Station Name: _____ Date & Time of Shut-Down: _____
Weather: _____
Type of Event (circle one): Thunderstorm Rain Snow Mix Snowmelt

SAMPLER INSPECTION	OK/not OK	Observations &/or Actions Taken to Correct
Desiccant Indicator (color)	Blue/Pink	_____
Flow Monitor Connections	_____	_____
Pump Tubing Conditions	_____	_____
Intake Tubing Connections	_____	_____
Intake Tubing Conditions	_____	_____

SET-UP CHECKS – FLOW METER

_____ Total Flow (X 10) (l): _____ Total Rainfall (cm): _____ Level (cm): _____
_____ Insert trigger volume: Trigger Volume (cf):_____ Predicted Rainfall (in.)_____
_____ Review flow meter programming
_____ Verify flow meter is "RUNNING"
_____ Check and replace battery if voltage is below 12.0 volts Volts: _____

SET-UP CHECKS – SAMPLERS

Influent Can #1	Effluent Can #2	
_____	_____	Check sampler programs with entries (listed in on-site notebook)
_____	_____	Sampler date/time match flow meter date/time
_____	_____	Insert sample bottles (check for proper bottle position) and put ice in samplers
_____	_____	Remove lids and put in zip-lock bags (place lids on housing shelf)
_____	_____	Check intake lines for kinks, bends, or dips
_____	_____	Start sampler programs (confirm "Program Running")
_____		Call Storm Event Coordinator

BOTTLE REPLACEMENTS

Influent	Effluent	
_____	_____	Halt sampler programs, expose bases, call Storm Control
_____	_____	Total Flow (X 10) (l): _____ Total Rainfall (cm): _____
_____	_____	Record trigger times in Sample Identification Form
_____	_____	Put lids on sample bottles
_____	_____	Complete Field Data Log and Sample Identification Form
_____	_____	Properly label full sample bottles and place in cooler with ice
_____	_____	Place a clean set of bottles in samplers
_____	_____	Check intake lines for kinks, bends, or dips
_____	_____	Check and replace battery if voltage is below 12.0 volts Volts: _____
_____	_____	**RESTART** sampler programs, verify "Program Running" **DO NOT "RESUME" the program**

SHUT-DOWN CHECKS

Influent	Effluent	
_____	_____	Halt sampler programs
_____	_____	Record Trigger times in the Sample Identification Form
_____	_____	Put lids on sample bottles and properly label sample bottles
_____	_____	Place samples in cooler with ice
_____	_____	Total Flow (X 10) (l): _____ Total Rainfall (cm): _____ Level (cm): _____
_____	_____	Estimate Sample Success: # of Successful Samples_____ Time Runoff Started_____
		Time of First Sample_____ Time of Last Sample_____
		Time Runoff Ended_____ First Portion of Flow Captured yes/no
		Last Portion of Flow Captured yes/no Was peak flow captured yes/no
		Estimate Storm Capture _____%
_____	_____	Download Data with DTU
_____	_____	Shut samplers off
_____	_____	Complete Chain of Custody form

SEDIMENT SAMPLING CHECK - (measure depth to sediment, check filter at box)

Influent can #1 (depth to sediment, in.) _____ Effluent can #2 (depth to sediment, in.) _____
Filter box (check filter) _____

PRECIPITATION MONITORING CHECKLIST

Date & Time of Setup: _____ Date & Time of Shut-down: _____

SET-UP CHECKS

_____ Total Rainfall (cm): _____
_____ Clear bucket of any debris
_____ Unwrap bucket liner using clean sampling techniques
_____ Insert liner into holding bucket

SHUT-DOWN CHECKS

_____ Type of rainfall: Rain Snow Rain/Snow Mix
_____ Remove liner from bucket
_____ Pour samples into 1-L poly nalgene sample container
_____ Put lid on sample bottle
_____ Properly label sample bottle
_____ Total Rainfall (cm): _____
_____ Complete Chain of Custody form

SNOWMELT MONITORING LOG

Date & Time: _____

Weather: Temperature: _____ Cloud Cover: _____ Wind Direction: _____

Recent Snow Management Activities Conducted by Caltrans

Sanding/Salting _____
Brine Solution Application _____
Plowing _____
Blowing _____

Visual Condition of Snow in Sampling Area

Fresh Snowfall _____
Accumulated Snowpack _____

Approximate Depth of Snow Within Drainage Area

New Snow (in) _____
Snow Banks (in) _____
Snowpack (in) _____

Snow Removal Conducted at Site: Yes No

Runoff Appearance

Color/Clarity: _____
Apparent Source: _____
Debris/Litter: _____

COMMENTS/PROBLEMS DURING SAMPLING EVENT?

SAMPLE IDENTIFICATION FORM
INFLUENT SEDIMENT CAN #1

Sediment Trap Effectiveness Study

Station ID Name: .....
24 hr. time: .....
Date: .....

Directions: To fill out the following table, press down on the "time read" key on the sampler pad and hold down until the first sample time appears on the display. After the sample time has been recorded, press the enter key and the second sample time will appear on the display. Continue in this manner until all sample times are recorded on the following table:

Trigger #	Date	Time	Notes (e.g., missed trigger)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

SAMPLE IDENTIFICATION FORM
EFFLUENT SEDIMENT CAN #2

Sediment Trap Effectiveness Study

Station ID Name: .....
24 hr. time: .....
Date: .....

Directions: To fill out the following table, press down on the "time read" key on the sampler pad and hold down until the first sample time appears on the display. After the sample time has been recorded, press the enter key and the second sample time will appear on the display. Continue in this manner until all sample times are recorded on the following table:

Trigger #	Date	Time	Notes (e.g., missed trigger)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

Sediment Sampling Form

CALTRANS SEDIMENT TRAP TREATMENT EFFECTIVENESS STUDY

Date/Time _____

Period of Accumulation (months) _____

	Sediment Trap 1			Sediment Trap 2			Filter Box		
Site #	Bottom of inlet opening to top of water (in)	Bottom of inlet opening to sediment (in)	Empty Dimensions (in.) diameter X depth	Bottom of weir plate to top of water (in)	Bottom of weir plate to sediment (in)	Empty Dimensions (in.) diameter X depth	Filter Box Dimension	Depth of Sediment (in.)	Cleaning Date
3-202 Tahoe Airport			36" X 73"			36" X 73"	18.5"X42.5"X10"		Aug-02
3-203 Echo Summit			36" X49"			36" X58"	18.5"X42.5"X10"		Jul-02

	Sediment Trap 1			Sediment Trap 2			Filter Box
Site #	Sample Type Collected	Number of Samples	Dimensions (in.) or weight (lbs.)	Sample Type Collected	Number of Samples	Dimensions (in.) or weight (lbs.)	Weight (lbs.) with Filter Bag
3-202 Tahoe Airport							
3-203 Echo Summit							

Tahoe Airport Site #3-202
Can #1 - total depth measured from bottom of inlet opening to bottom of can.
Can #2 -total depth measured from bottom of weir plate to bottom of can
Filter Box

Echo Summit Site #3-203
Can #1 - total depth measured from bottom of inlet opening to bottom of can.
Can #2 -total depth measured from bottom of weir plate to bottom of can.
Filter Box

Comments: _____

_____

FIELD SAMPLE COLLECTION DATA LOG
(fill out one for each station visit)
Treatment Effectiveness Study

GENERAL

Station ID #_____ Your Name_____

Date/24-HR Time_____ Field Crew_____

COMPOSITE SAMPLES COLLECTED: (carboys)

Bottle #	Sample ID	Sample Volume (e.g., ¼, 1/2, 3/4, full)	Date, 24-hr Time, Missed Triggers
1			
2			
3			
4			

PRECIPITATION SAMPLES COLLECTED: (nalgene bottles)

Bottle #	Sample ID	Sample Volume (e.g., ¼, ½, ¾, full)	Date, 24-hr Time
1			
2			
3			

SEDIMENT SAMPLES COLLECTED

Filter Location	Sample ID	# of Containers	Date, 24-hr Time
Influent can #1			
Effluent can #2			
Filter box			

COMMENTS:_____
_____
_____
_____
_____
_____
_____
_____
_____

STORMWATER RUNOFF WATER QUALITY STUDY FORMS

STATION VISIT CHECKLIST FOR SETUP/BOTTLE REPLACEMENT/SHUT-DOWN

Water Quality Study

Set-Up Crew Name: _____ Date & Time of Set-Up: _____
Station Name: _____ Date & Time of Shut-Down: _____
Weather: _____
Type of Event (circle one): Thunderstorm Rain Snow Mix Snowmelt

SAMPLER INSPECTION	OK/not OK	Observations &/or Actions Taken to Correct
Desiccant Indicator (color)	_____	_____
Flow Monitor Connections	_____	_____
Pump Tubing Conditions	_____	_____
Intake Tubing Connections	_____	_____
Intake Tubing Conditions	_____	_____

SET-UP CHECKS – FLOW METER

_____ Total Flow (X 10) (l): _____ Total Rainfall (cm): _____ Level (cm): _____
_____ Insert trigger volume
_____ Review flow meter programming
_____ Verify flow meter is "RUNNING"
_____ Check and replace battery if voltage is below 12.0 volts Volts: _____

SET-UP CHECKS – SAMPLER

_____ Check sampler program with entries (listed in on-site notebook)
_____ Sampler date/time match flow meter date/time
_____ Insert sample bottle (check for proper bottle position)
_____ Put ice in sampler
_____ Remove lid and put in zip-lock bag (place lids on housing shelf)
_____ Start sampler program (confirm "Program Running")
_____ Check intake line for kinks, bends, or dips
_____ Call Storm Control

BOTTLE REPLACEMENTS

_____ Halt sampler program, expose base, call Storm Control
_____ Total Flow (X 10) (l): _____ Total Rainfall (cm): _____
_____ Record trigger times
_____ Put lid on sample bottle
_____ Complete Field Data Log and Sample Identification Form
_____ Properly label full sample bottle
_____ Place bottle in cooler with ice
_____ Place a clean bottle in sampler
_____ Check intake line for kinks, bends, or dips
_____ Check and replace battery if voltage is below 12.0 volts Volts: _____
_____ **RESTART** sampler program, verify "Program Running" DO NOT "RESUME" the Program

SHUT-DOWN CHECKS

_____ Halt sampler program
_____ Record in the Sample Identification Form
_____ Put lid on sample bottle
_____ Properly label sample bottle
_____ Total Flow (X 10) (l): _____ Total Rainfall (cm): _____ Level (cm): _____
_____ Estimate Sample Success: # of Successful Samples_____ Time Runoff Started_____
Time of First Sample_____ Time of Last Sample_____
Time Runoff Ended_____
First Portion of Flow Captured yes/no
Last Portion of Flow Captured yes/no
Was peak flow captured yes/no
Estimate Storm Capture _____%
_____ Complete Chain of Custody form
_____ Shut sampler off

PRECIPITATION MONITORING CHECKLIST

Date & Time of Setup: _____ Date & Time of Shut-down: _____

SET-UP CHECKS

_____ Total Rainfall (cm): _____
_____ Clear bucket of any debris
_____ Unwrap bucket liner using clean sampling techniques
_____ Insert liner into holding bucket

SHUT-DOWN CHECKS

_____ Type of rainfall: Rain Snow Rain/Snow Mix
_____ Remove liner from bucket
_____ Pour samples into 1-L poly nalgene sample container
_____ Put lid on sample bottle
_____ Properly label sample bottle
_____ Total Rainfall (cm): _____
_____ Complete Chain of Custody form

SNOWMELT MONITORING LOG

Date & Time: _____

Weather: Temperature: _____ Cloud Cover: _____ Wind Direction: _____

Recent Snow Management Activities Conducted by Caltrans

Sanding/Salting _____
Brine Solution Application _____
Plowing _____
Blowing _____

Visual Condition of Snow in Sampling Area

Fresh Snowfall _____
Accumulated Snowpack _____

Approximate Depth of Snow Within Drainage Area

New Snow (in) _____
Snow Banks (in) _____
Snowpack (in) _____

Snow Removal Conducted at Site: Yes No

Runoff Appearance

Color/Clarity: _____
Apparent Source: _____
Debris/Litter: _____

COMMENTS/PROBLEMS DURING SAMPLING EVENT?

SAMPLE IDENTIFICATION FORM

Stormwater Runoff Water Quality Study

Station ID Name: .....
24 hr. time: .....
Date: .....

Directions: To fill out the following table, press down on the "time read" key on the sampler pad and hold down until the first sample time appears on the display. After the sample time has been recorded, press the enter key and the second sample time will appear on the display. Continue in this manner until all sample times are recorded on the following table:

Trigger #	Date	Time	Notes (e.g., missed trigger)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			

FIELD SAMPLE COLLECTION DATA LOG
(fill out one for each station visit)
Water Quality Study

GENERAL

Station ID #_____ Your Name_____

Date/24-HR Time_____ Field Crew_____

COMPOSITE SAMPLES COLLECTED: (carboys)

Bottle #	Sample ID	Sample Volume (e.g., ¼, 1/2, 3/4, full)	Date, 24-hr Time, Missed Triggers
1			
2			
3			
4			
5			
6			
7			
8			

PRECIPITATION SAMPLES COLLECTED: (nalgene bottles)

Bottle #	Sample ID	Sample Volume (e.g., ¼, ½, ¾, full)	Date, 24-hr Time
1			
2			
3			
4			

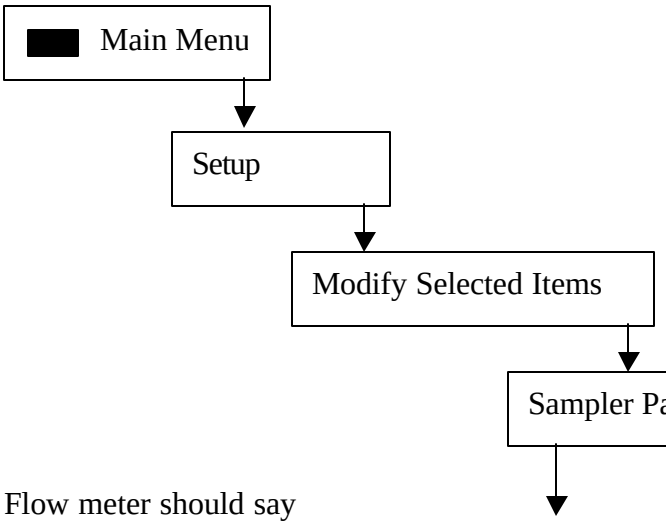
COMMENTS:_____
_____
_____
_____
_____
_____
_____
_____
_____

Appendix D

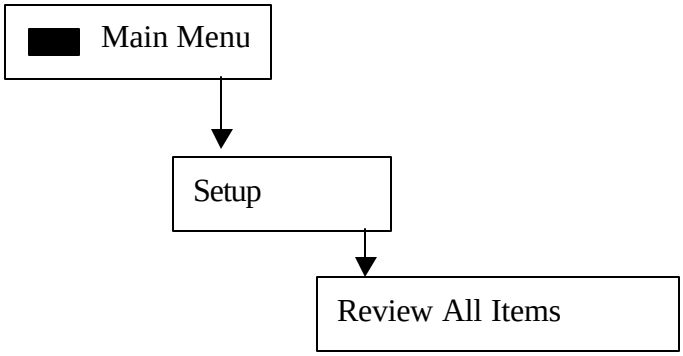
FLOW CHARTS

SET UP INSTRUCTIONS

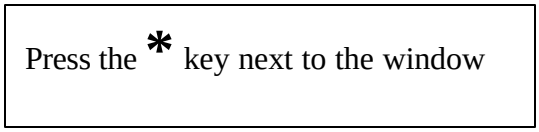
1) Insert Trigger Volume per SEC



2) Review Flow Meter Programming

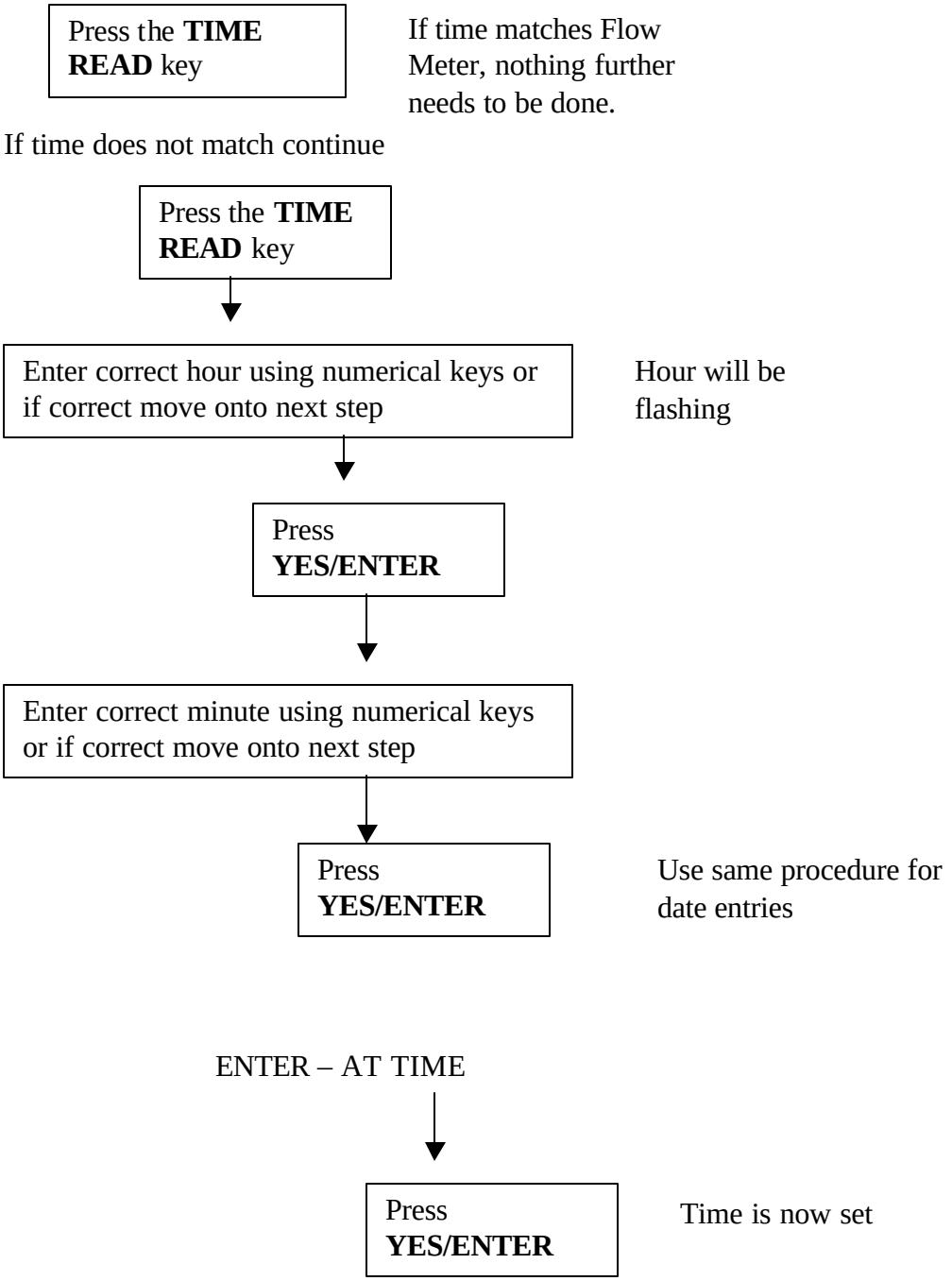


3) Check Sampler Program Parameters



Refer to the back of page one (section 2) for program parameters. Make sure sampler reads the same as the sheet. When asked if you want to alter parameters push **NO**

4) Sampler Date Time Match Flow meter Date Time



SHUT DOWN INSTRUCTIONS

1) Halt Sampler Program

Press **HALT** Key

Program may be complete, if complete move to next step

2) Record Trigger Times from Sampler on sample identification sheet (section 4)

Press **TIME READ** key and hold for 3 seconds

This will bring up first trigger date/time

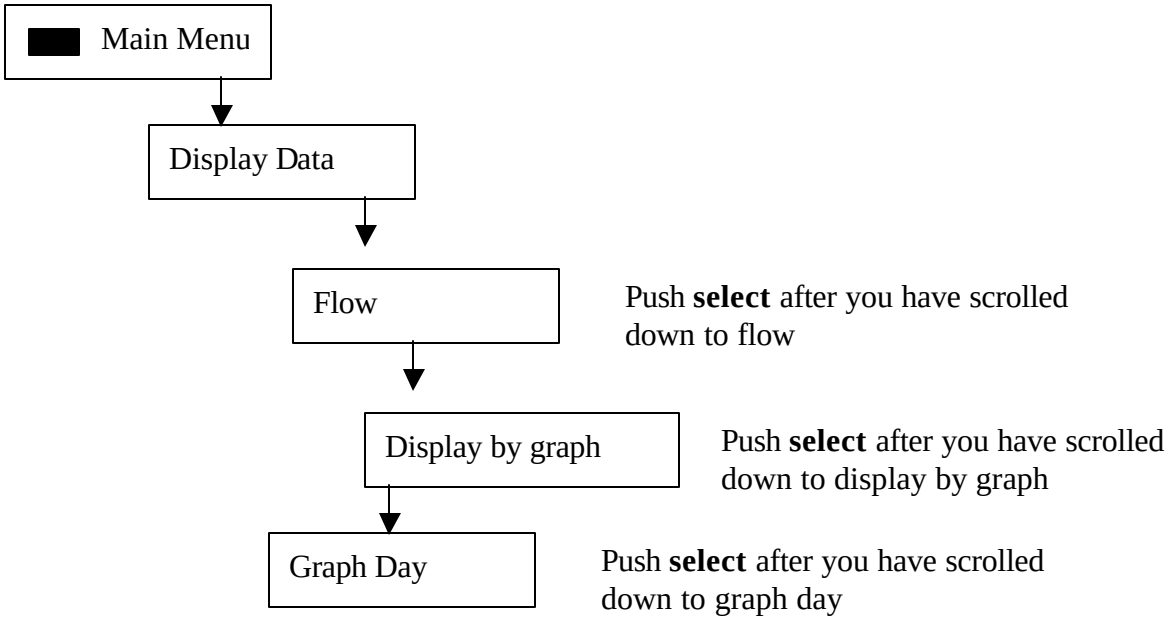
↓

Press **ENTER** key

This will bring up second trigger date/time

Continue pressing **ENTER** and recording triggers until the screen says "PROGRAM HALTED" or "PROGRAM COMPLETE"

3) To Estimate Sample Success



Enter in sampling date and then push **Select**

Use white keys on right to scroll along the graph.
Place line at beginning, end and peak of flow to estimate percentage captured